SEAT BUS STUDY

FINAL REPORT

October 2015

SCCOG

SEAT

CONNECTICUT DEPARTMENT OF TRANSPORTATION

NELSON NYGAARD ASG PLANNING

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1 RECOMMENDATION

BACKGROUND

The Southeastern Connecticut Council of Governments (SCCOG), working closely with the Southeast Area Transit (SEAT) District, has undertaken a Comprehensive Operations Analysis (COA) of SEAT services. This COA, called the "SEAT Bus Study," was performed in order to identify cost neutral service improvements that would better serve existing riders, improve the overall efficiency of SEAT service, and attract more riders.

Today, SEAT provides service to 10 member communities, serving a number of key population and employment centers that are distributed (and often geographically isolated) across a service district that has a mix of urban and rural areas. Due to limited resources, about half of SEAT's routes offer service only every two hours, many end service before 7 p.m., and only four routes operate on Sundays. These limitations can make it challenging for many in the southeastern Connecticut region to access work, school, and needed services, particularly lower income individuals and those without access to other transportation. Increased transit frequency and additional weekend service are critically needed in the SEAT region.

Three alternative service plans were evaluated in depth and brought to the public and SEAT's Board of Directors for comment. This review included two plans that would be cost neutral on a systemwide basis, allowing SEAT to move forward with implementation within their existing operating budget. Given the need to more adequately serve the local population and enhance regional mobility, a third plan was also developed to identify priorities for system expansion if additional budget resources were to become available in the future.

RECOMMENDED SEAT IMPROVEMENT PLANS

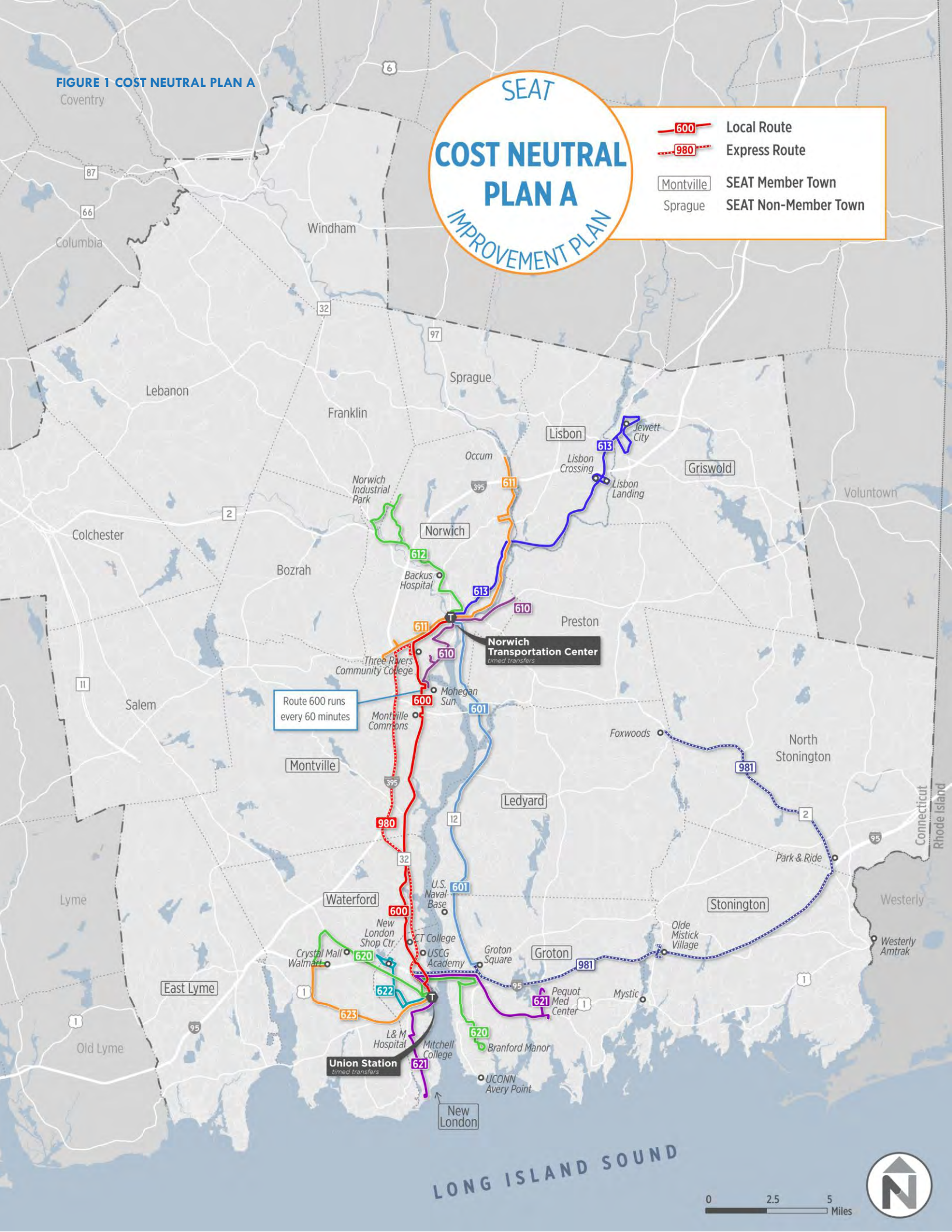
The **Recommended SEAT Improvement Plans** represent a set of service improvements that would be budget neutral when implemented on a systemwide basis. The plan would improve the overall efficiency of SEAT service, better meet customer needs and increase ridership by an estimated 13-16%. Increased fare revenues would make the service more efficient, possibly lowering overall annual operating costs on a net basis. These plans offer service design modifications on 16 of 17 existing SEAT routes to make service more efficient, more direct, faster, and more reliable. All SEAT routes would also be renumbered to correspond with new statewide transit route numbering.

Two SEAT Improvement Plans are presented as options for implementation: both plans are budget neutral when implemented on a systemwide basis, and each provides the service design benefits described above.

BENEFITS OF RECOMMENDED PLANS

- Easy to understand service
- Faster trips
- Fewer transfers
- Improved reliability
- Increased ridership
- Enhanced mobility

FIGURE 1 COST NEUTRAL PLAN A



The **Cost Neutral Improvement Plan A** (see Figure 1) provides increased frequency (from every two hours to hourly) on Route 600 between Norwich and New London, strengthening service in this corridor that serves as the "backbone" of SEAT's system. Route 980 express service would also be implemented in this corridor, replacing Three Rivers Community College trips, and taking 30 minutes as opposed to 60 minutes today. Plan A also calls for discontinuation of three existing routes, including two low ridership routes in East Lyme and Stonington. Evening service in New London (formerly called Run 15) would be replaced by extended service spans on existing daytime routes.

The **Cost Neutral Improvement Plan B** (see Figure 2) largely offers similar improvements to improve the efficiency of routes across the region. However, instead of discontinuing service along Route 1 in Stonington and along Flanders Road to Niantic, it maintains coverage in these lower ridership areas in lieu of increasing service levels in the New London-Norwich corridor. This plan was of interest to SEAT Board members and is further detailed in Chapter 3 below.

PRIORITY ACTIONS FOR SYSTEM EXPANSION

The Recommended SEAT Improvement Plans also include a series of priority actions for future system expansion, if and when additional resources are identified. These actions would extend service spans, add weekend service, and increase service frequency, particularly in the central urban cores of New London, Norwich, and Groton where ridership demand is strongest. These actions would respond to the strong calls for extended service on existing routes voiced by SEAT riders during the public outreach process conducted for this study.

The **System Expansion Plan C** is shown in Figure 3. More specifically, these expansion priorities include:

- Additional express service trips between New London and Norwich
- Sunday service on a total of eight routes, as compared to four today
- Extended service (earlier AM and/or later PM) on weekdays and Saturdays on nine routes
- A new route connecting Norwich with employment opportunities at the Foxwoods Resort Casino
- A new Groton local route, connecting major employers and residential populations in the City of Groton to Groton Square and the US Naval Base
- Restoring service in Stonington and East Lyme, including a new seasonal Mystic Shuttle operating from May to October each year

Collectively, if all expansion actions were pursued, the cost of service would increase by an estimated 25.7%. However, due to an anticipated increase in ridership as additional service is directed to core parts of the system, the net annual increase in SEAT operating costs would be less than 10%.

It is recommended that SEAT, working with SCCOG, take action to implement one of the **Cost Neutral Improvement Plans** for improved system efficiency over the near term. These partners should also pursue additional funding to implement the **System Expansion Plan** to better meet transit demand and mobility needs in the southeastern Connecticut region. Finally, SEAT should work with state and regional partners to advance another $6-$10 million in one-time capital improvements that would enhance the efficiency of transit service and better serve SEAT riders.

FIGURE 2 COST NEUTRAL PLAN B

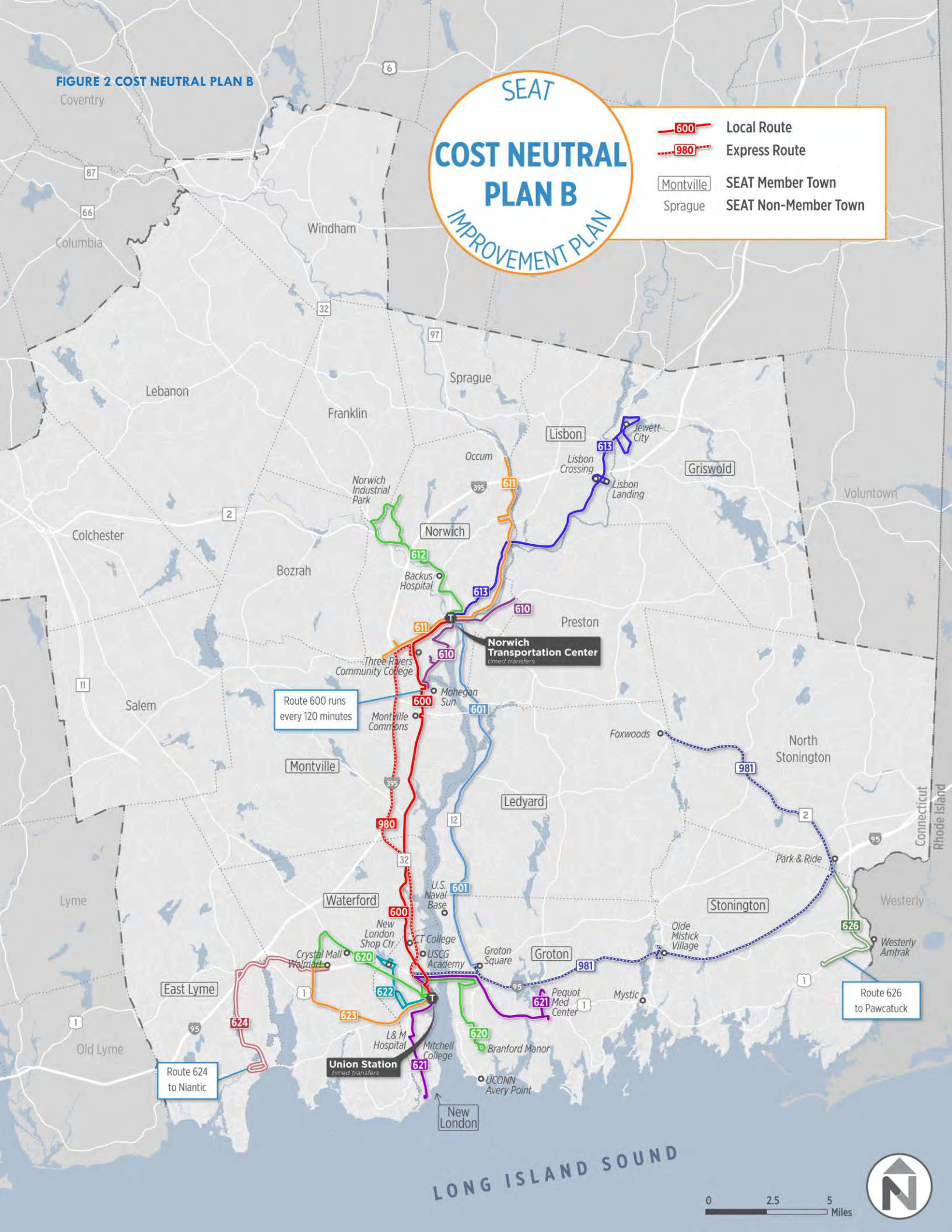
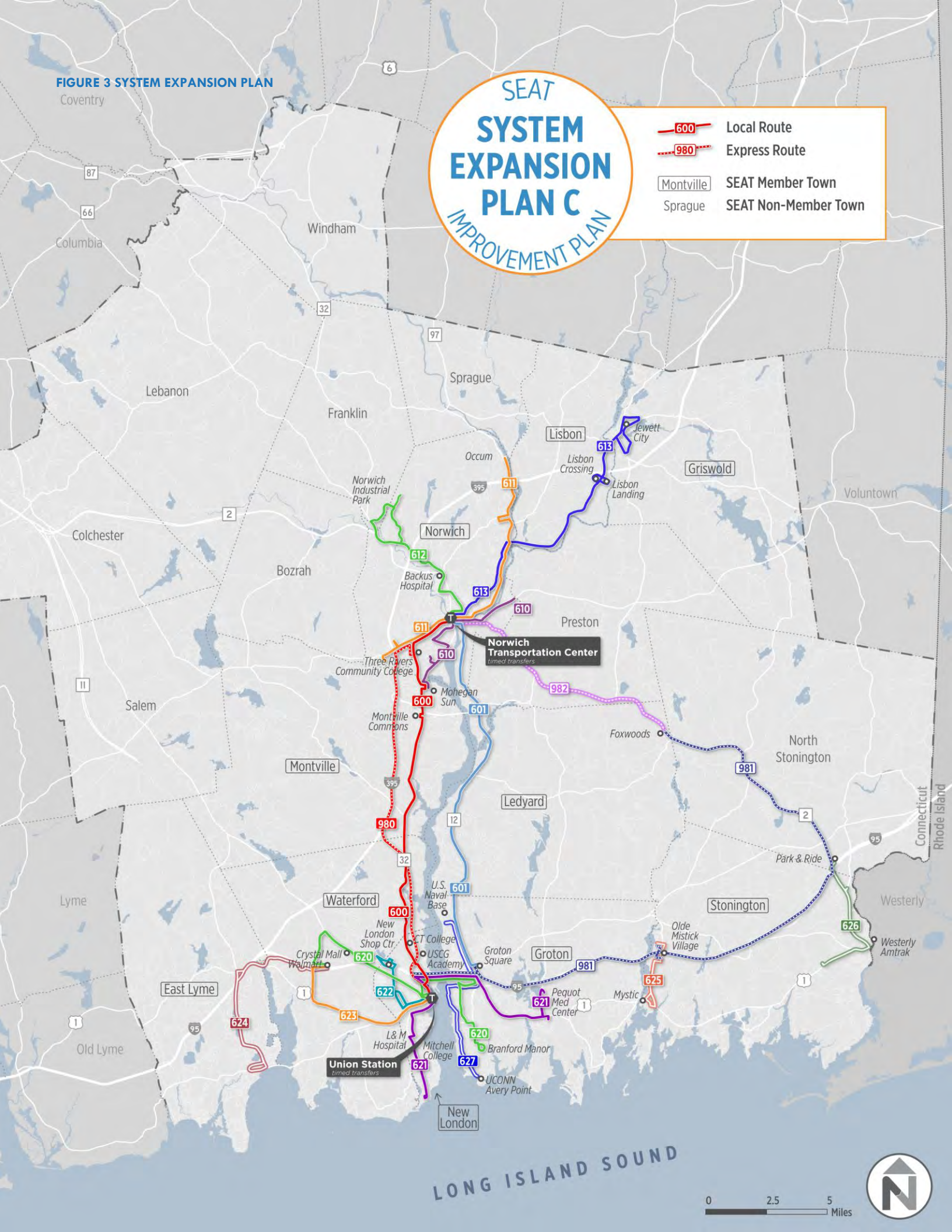


FIGURE 3 SYSTEM EXPANSION PLAN



2 THE SEAT TRANSIT SYSTEM TODAY

System Overview

The Southeast Area Transit District (SEAT) serves the 10 member municipalities of East Lyme, Griswold, Groton, Ledyard, Lisbon, Montville, New London, Norwich, Stonington, and Waterford in southeastern Connecticut (see Figure 4). SEAT provides service on 17 bus routes within these communities. SEAT also contracts with the Eastern Connecticut Transportation Consortium to provide complementary ADA paratransit service for those who live within ¾ of a mile of these routes but are unable to use fixed-route services.

The 10 SEAT member communities are part of the Southeastern Connecticut Council of Governments (SCCOG), a regional planning coalition that also includes the non-SEAT member municipalities of Windham, Lebanon, Franklin, Sprague, Colchester, Bozrah, Salem, Preston, and North Stonington. SEAT bus routes do pass through Preston and North Stonington, but do not stop to pick up riders in these non-member communities.

The 17 fixed routes operated by SEAT include longer corridor-based services and shorter local routes operating within one municipality. The adult base fare is $1.50 per trip, with free transfers provided upon request. There are three separate fare zones, with a $0.50 surcharge applied to the base fare for each zone crossed by a passenger.

The New London Union Station Intermodal Center and the Norwich Intermodal Transportation Center serve as major hubs for the SEAT system. Each of these locations serves as a key transfer location, where six or seven routes come together and "pulse," arriving and leaving on the hour to facilitate passenger connections.

Over the past few years, SEAT has taken a number of steps to improve its service and system. Adjustments have been made to improve service reliability, new vehicles have been purchased, and real time information is now available at the Norwich Transportation Center. Mobile applications are under development, which will soon allow riders to use smart phones to see where buses are in real time.

The first step of the SEAT Bus Study involved an in-depth review of the regional market demand for transit, as well as the performance of existing routes. The results of these analyses are summarized below.

Market Analysis

A market analysis was performed to examine underlying demographic conditions in the SCCOG region as they relate to the demand for transit service. Collectively, SEAT member communities had a 2010 population of 216,000, as compared to 286,711 in the broader SCCOG region. This is one indication that SEAT is currently focusing much of its service within more densely populated parts of the region.

The full market analysis focused on factors that are strongly correlated with transit demand including population and employment densities; areas populated by older individuals, individuals with low incomes or with disabilities; households without access to automobiles; and overall regional travel flows. The full Transit Market Analysis report is included as Appendix A.

FIGURE 4 SEAT ROUTE MAP / SCCOG MEMBER COMMUNITIES

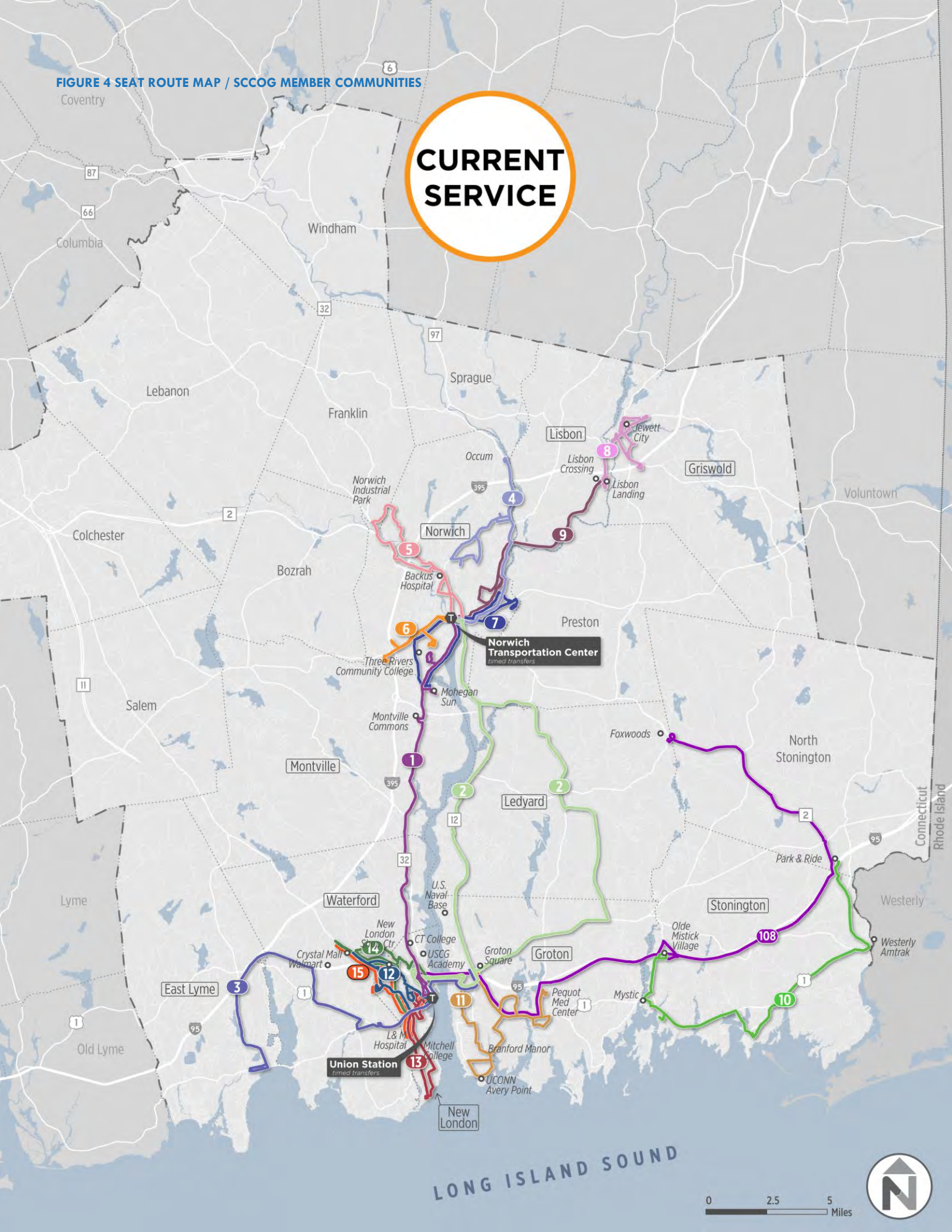


Figure 5 presents a "composite transit index" or a map of overall transit demand in the SCCOG region. This map indicates the likely level of transit service that could be effectively supported throughout the market area, based on existing population and employment densities. Key findings include:

- New London and parts of Norwich Groton are by far the most transit-supportive areas in the region, due to the clustering of jobs and population in close proximity. These communities represent the core of the SEAT service area, and can support the most significant and productive levels of transit service. Waterford also has areas with high or moderate demand.
- Several boroughs and key activity centers outside of these communities also demonstrate relatively high or moderate transit demand. However, these locations are geographically isolated from other areas of high demand, making them difficult for SEAT to serve effectively (e.g. Foxwoods Resort Casino, Mystic, Pawcatuck, Niantic, Lisbon Landing/Lisbon Crossing, and Jewett City). Linking these locations to the SEAT network requires routes to travel through areas with very low demand for transit. In these locations, alternative service strategies such as flex service, local circulator services or limited stop express service may be more appropriate transit service design models.
- The communities of Ledyard and Montville (with the exception of Mohegan Sun) have lower levels of density and transit demand, yet are well integrated into the SEAT network today as routes pass to connect to areas of higher demand.
- Three outlying communities – Windham, Colchester, and Westerly, RI – have moderate or high transit demand. While not currently SEAT members, there may be demand for improved regional transit connections with these locations, perhaps through coordination with other regional transit agencies serving these communities.
- Other outlying communities in the SCCOG region have a rural character and lack sufficient population and employment density to support fixed-route transit service (e.g. Bozrah, Franklin, Lebanon, North Stonington, Preston, Salem, and Sprague). SEAT should continue to follow their current strategy, directing resources to serve communities of higher density and demand.

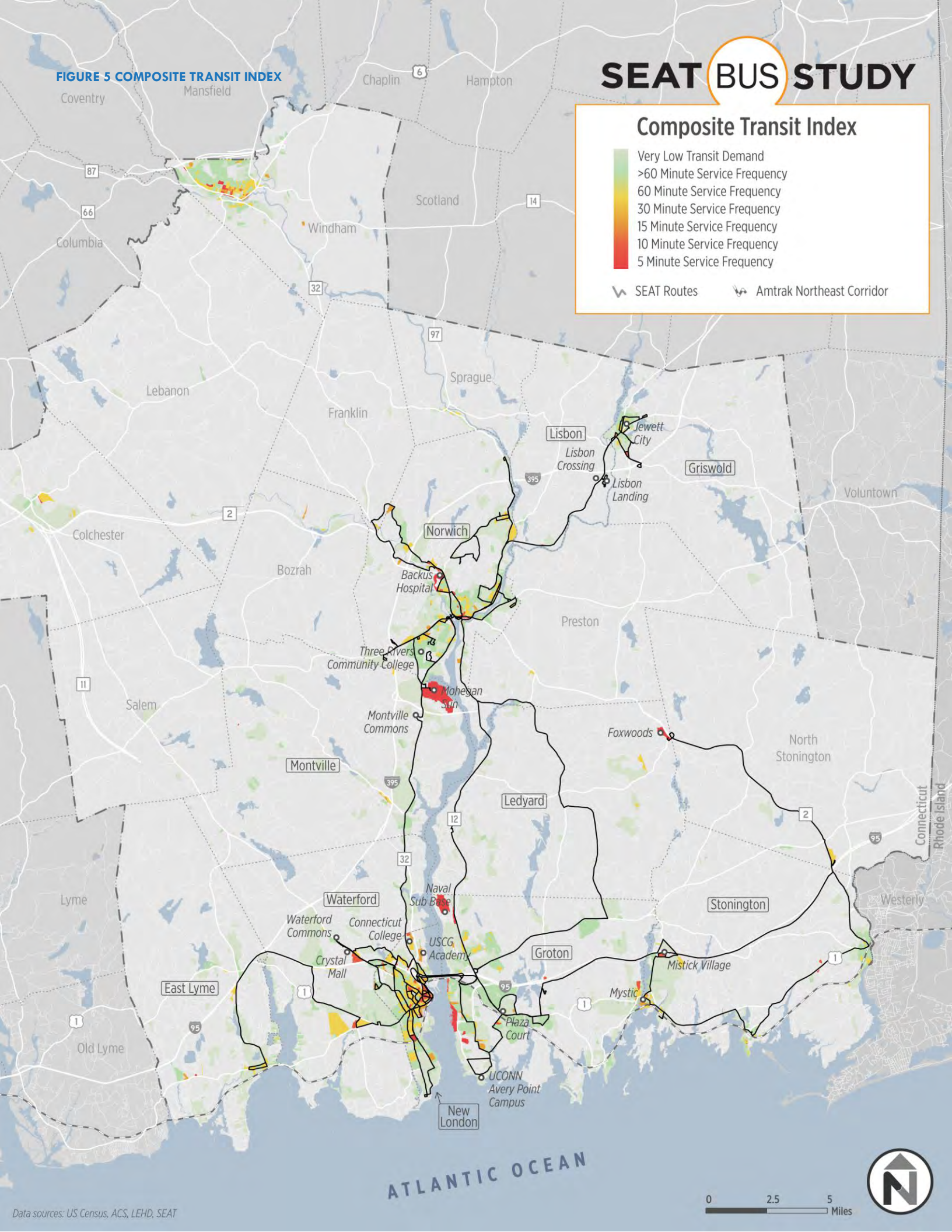
Evaluation of Existing Route Performance

SEAT service is operated seven days a week. On average, there are 4,000 weekday boardings on the system, or about 1.2 million trips per year.

The 17 scheduled routes include Run 15, which offers only evening service in New London, and the Three Rivers Community College Express, which offers seven trips per day. A total of 14 routes operate on Saturday and only four routes operate on Sunday.

In October 2014, a manual count of passengers boarding and alighting from all SEAT trips was performed. These "ride checks" were used to assess the individual markets served by each route, as well as overall performance by day of the week and time of day (trip). A summary of these ridership counts is shown in Table 1. (SEAT has since installed automated passenger counting devices and is now collecting ridership data on a daily basis.)

FIGURE 5 COMPOSITE TRANSIT INDEX



Data sources: US Census, ACS, LEHD, SEAT

TABLE 1 DAILY RIDERSHIP BY EXISTING SEAT RUN (OCTOBER 2014)

RUN	RUN DESCRIPTION	WEEKDAY RIDERSHIP	WEEKDAY RIDERS PER TRIP	SATURDAY RIDERSHIP	SATURDAY RIDERS PER TRIP	SUNDAY RIDERSHIP	SUNDAY RIDERS PER TRIP
1	Norwich/Mohegan Sun/NL	477	23.9	342	17.1	63	4.5
2	Norwich/Groton/New London	201	16.8	125	10.4		
3	Groton/NL/Niantic	154	12.8	-	-	-	-
4	Taftville/Occum/Greenville	338	26.0	207	17.3	-	-
5	Industrial Park/Backus Hosp.	349	15.9	171	10.7	-	-
6	West Side (Norwich)	457	19.0	219	13.7	-	-
7	Hamilton Ave./Mohegan Sun	593	34.9	369	28.4	154	10.3
8	Jewett City/Lisbon Landing	138	9.2	87	5.8	-	-
9	Norwich/Lisbon Landing	383	13.7	261	9.3	-	-
10	Pawcatuck/Mystic	22	2.2	-	-	-	-
11	Groton Local	283	10.5	170	6.8	98	5.8
12	Jefferson Ave./ Malls	256	11.6	260	11.8	-	-
13	L+M Hospital/Ocean Beach	228	9.5	145	6.6	-	-
14	Crystal Ave./Malls/Coleman	262	11.9	188	8.5	-	-
15	NL/Waterford evening service	31	5.1	37	4.6	-	-
108	NL/Groton/Mistick/Foxwoods	221	13.0	208	13.0	88	11.0
TR	Three Rivers Express	52	7.4	-	-	-	-
	System Average		**15.0**		**11.2**		**7.5**

Source: SEAT Ridecheck 2014

Figures 6 and 7 display the relative performance statistics for each run. Run 7, connecting Norwich with Mohegan Sun, and Run 1, connecting Norwich and New London, have the highest ridership. Other local Norwich bus runs (4, 5, 6, and 9) are also relatively productive. The Stonington (Run 10) and Jewett City (Run 8) services are the least productive runs with full weekday schedules.

FIGURE 6 - AVERAGE WEEKDAY RIDERSHIP

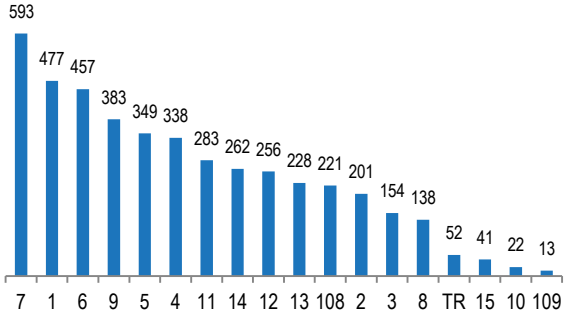
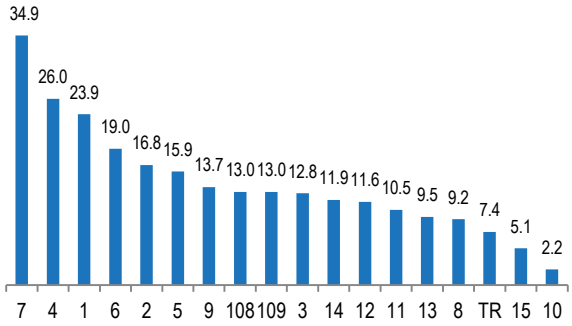


FIGURE 7 - AVERAGE WEEKDAY RIDERSHIP PER TRIP



Note: Run 109 operates supplemental service along the Run 1 corridor on State Route 32.

Stakeholder Outreach

Throughout the SEAT Bus Study, a high priority was to give everyone in the community an opportunity to participate. The project team provided as many ways as possible to interact, allowing people to share ideas and feedback in whatever way was most convenient and comfortable for them. Through a variety of online and in-person activities, there were multiple ways for SEAT bus riders and other community members to express their ideas and communicate their feedback. Summary reports of these efforts are provided in Appendix C.

OUTREACH BY THE NUMBERS

- ✓ 4 public meetings
- ✓ 9 outreach events, including workshop bus and tabling at key transit centers
- ✓ 144 written comments submitted at meetings and events
- ✓ 525 votes received through voting exercises at all events
- ✓ 22 interviews with stakeholders
- ✓ 316 completed tradeoff surveys
- ✓ 89 comments submitted through the SEAT Bus Study website

Stakeholder Interviews: A series of stakeholder interviews were conducted during the early phases of the study to better understand how members of the community perceive SEAT service. Interviews were conducted with 22 key stakeholders and representatives of organizations with clients that use SEAT.

Public meetings and events: Four public meetings were held during the course of the study, with two each in Norwich and New London. In addition, the project team also visited major transit stops to speak with riders and hear feedback. Riders were encouraged to learn about the study, participate in interactive voting exercises, and talk one-on-one with members of the project team. A workshop bus was brought to several events, featuring a SEAT transit bus outfitted with uniquely branded banners outside the bus and workshop materials inside.

Website and online engagement: The SEAT Bus Study website (www.SEATBusStudy.com) provides easy access to information about the study and its progress, and served as a convenient way for people to share written comments and feedback. Announcements about public events were shared via email with people who signed up to receive project notices. A tradeoff survey was also administered online, which allowed respondents to quickly and easily identify the service priorities that are most important to them.

What we heard:

1. *Service is very slow. It takes forever to get anywhere.*
2. *There is not enough Sunday service.*
3. *Bus schedules are unreliable.*
4. *Service information is hard to find and read.*
5. *Weekday service ends too early.*
6. *We don't like flag stops.*
7. *Zone fare system is confusing.*
8. *Service should be more direct.*
9. *More New London-Groton service is needed.*
10. *Stronger Norwich-New London service needed.*

3 DEVELOPMENT OF ALTERNATIVES

METHODOLOGY

A number of different ideas for improving the effectiveness of each individual SEAT route were developed based on stakeholder outreach, the market analysis, and the ridership counts performed at the outset of the study. The different concepts for each route also followed a set of transit service principles established for SEAT. A detailed evaluation for each of the 17 existing SEAT runs, including a description of alternative service concepts considered, is included in Appendix B.

Alternative service proposals were brought to the public in February 2015; several ideas for new routes were also proposed. Based on rider feedback, preferred concepts were combined to create three systemwide service plans. Two of these plans were designed to be cost-neutral on a systemwide basis; the third plan identifies a number of priority actions that might be considered if additional budget resources are identified.

This chapter describes the established SEAT transit design principles, shows proposed changes by individual SEAT route, and describes the three alternative systemwide service plans:

- Cost Neutral Plan A
- Cost Neutral Plan B
- System Expansion Plan C

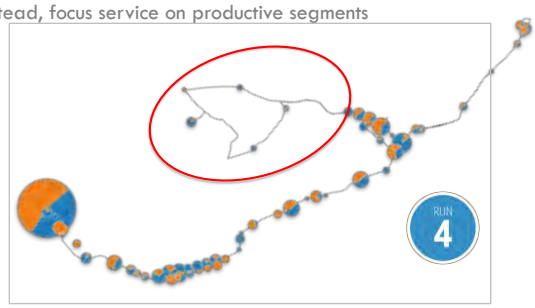
SERVICE DESIGN PRINCIPLES

A set of service design principles has been established as part of SEAT's new Service Guidelines (refer to Appendix D). Service elements that will attract one type of rider to transit can deter other riders, and SEAT must balance these types of competing demands. However, there are also certain service design principles that will improve service for nearly all riders. These principles are summarized below, and are also included in the Service Guidelines in Appendix E.

- **Service should be simple.** For people to use transit, service should be designed so that it is easy to understand. Many SEAT routes are complex. Improvements would make service intuitive, logical, and easy to understand.
- **Service should be fast and direct.** Service that meanders and repeats itself can be slow and hard to figure out. Many SEAT routes operate as loops, fo out-of-direction travel. Routes should operate alo major roadways and be as direct as possible.
- **Major routes should operate along arteria** Regional, express, and long distance routes shou offer fast service. Operating bus service along art makes transit service faster and easier for riders understand and use.
- **Routes should be symmetrical**. Many SEAT operate in loops, offering service in only one dire and forcing passengers to travel out of their way least one segment of their round trip. With bidirectional service (where runs serve the same in both directions), passengers benefit from more direct and convenient service.
- **Route deviations should be minimized.** Turning off major arterials to serve small roads with limited ridership wastes valuable resources and slows down through service for the majority of other riders. Service should be focused on productive segments.
- **Routes should serve well-defined markets.** Although urbanized areas in the SEAT system benefit from a number of transit runs, these runs often operate along the same corridors. Routes should be designed to serve distinct markets.
- **Most trips should be possible with one transfer.** Certain trips within the SEAT district require taking up to three buses, such as a trip from Groton to Waterford or from Jewett City to Three Rivers Community College. Services should be combined or modified to offer more one-seat rides where possible.

Strategy: Discontinue Unproductive Segments

- Unproductive segments waste valuable resources
- Unproductive deviations slow down thru-service
- ✓ Instead, focus service on productive segments



SEAT ROUTE RENUMBERING

At the request of the Connecticut Department of Transportation (CTDOT), any future service changes implemented by SEAT will also introduce a new statewide bus route numbering system. SEAT "Runs" will now be called "Routes" with numbers 600-630; express routes that utilize limited access highways for part of their route will be numbered 980-982. Figure 8 provides a map to help correlate existing SEAT run numbers with proposed new route numbers.

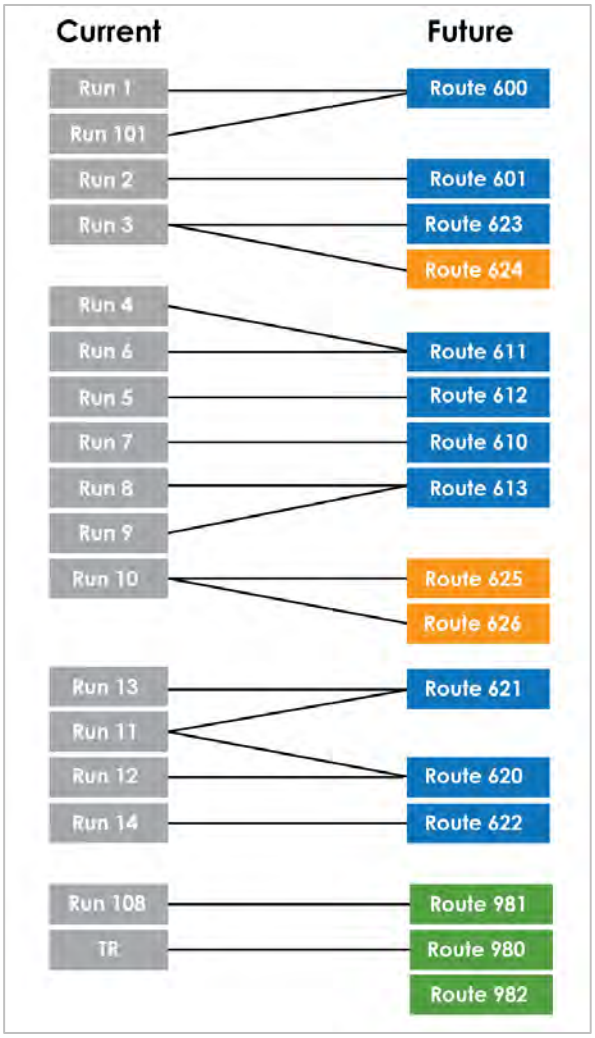
PROPOSED ALIGNMENT CHANGES BY ROUTE

Before creating alternative service plans, recommended alignment changes by route were developed.

Alignment changes are recommended for each route in the SEAT system. These improvements are intended to make each SEAT route more attractive to riders by adopting best practices in transit service design. A number of new routes are also proposed to serve areas with identified transit demand not well served today, or to connect key activity centers.

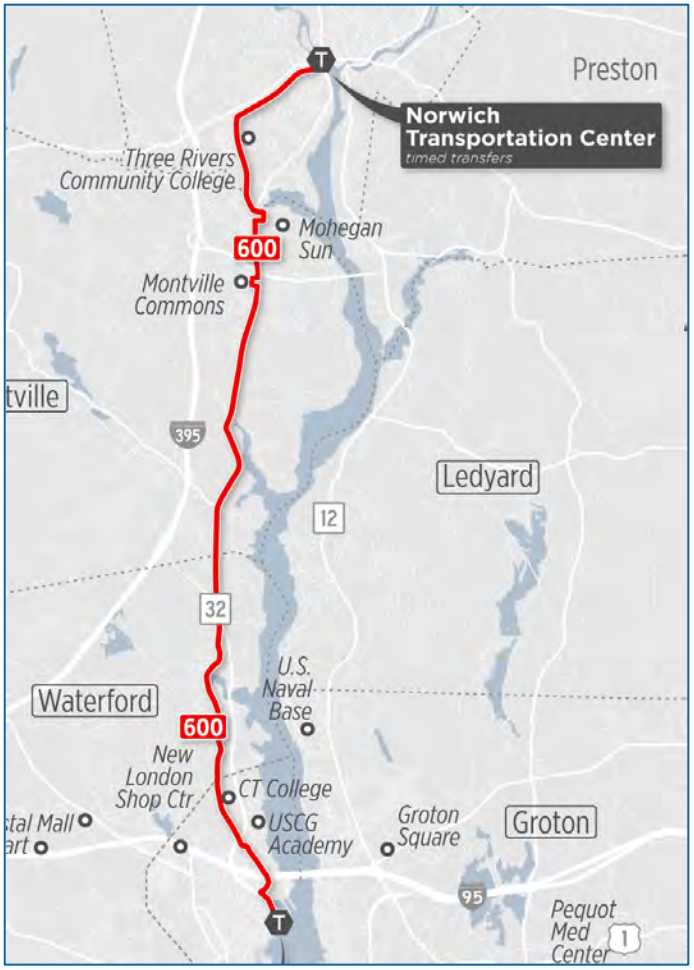
The following pages present a side-by-side comparison of existing SEAT routes with proposed alignment modifications and potential new routes.

FIGURE 8 PROPOSED ROUTE RENUMBERING



Run 1 Norwich-New London

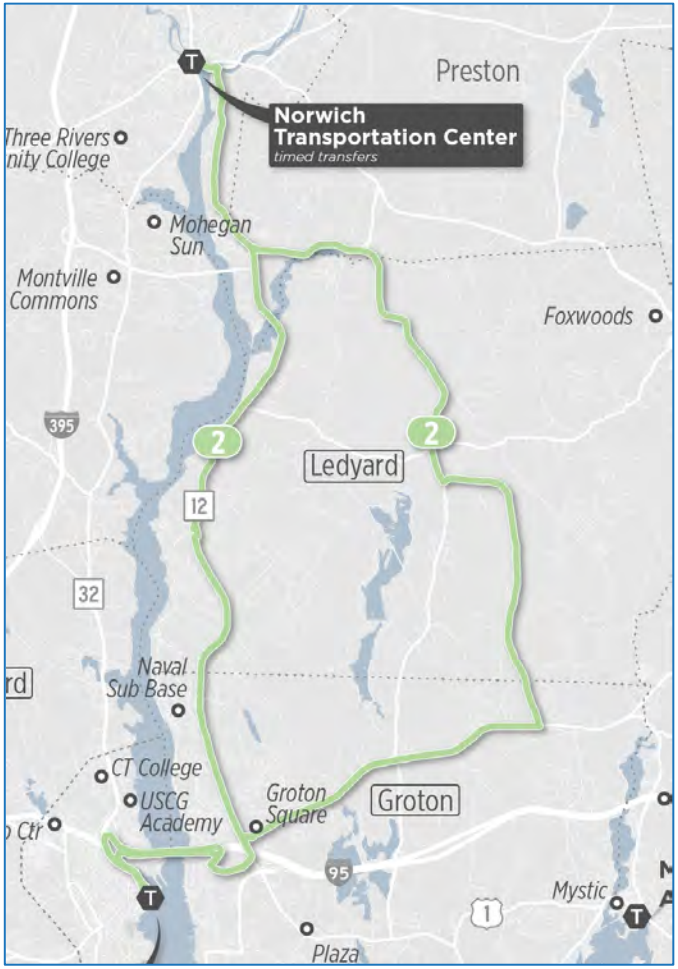
Proposed Route 600 Norwich-New London



Route 600

- Run 1 and 101 trips consolidated into one route.
- New London segment serves Crystal Avenue.
- Norwich segment uses New London Avenue and W. Main Road rather than Thames Street.
- Continues to operate locally along SR 32 and into Montville Commons and Mohegan Sun.
- Provides more frequent and direct service to Three Rivers Community College from both downtown Norwich and New London.
- Uncas on Thames now served by new Route 610.

Run 2 Norwich-Groton-New London

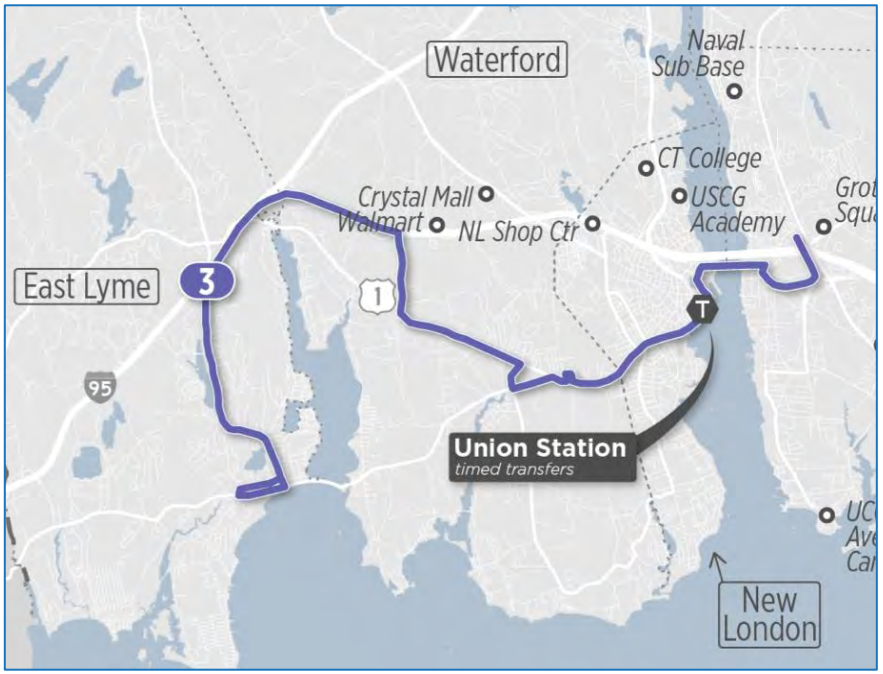


Proposed Route 601 Norwich-Groton

Route 601

- Operates along same alignment in both directions, rather than as a one-way loop.
- Ledyard Center segment has little ridership and would be discontinued.
- US Naval Base, Gales Ferry, and other locations along SR 12 would benefit from service in both directions.
- Route would terminate at Groton Square, where connections to New London, Foxwoods, and other Groton points could be made.
- Route would make short deviation onto Crystal Lake Road once SEAT and Naval Base find agreeable turnaround location.

Run 3 Groton-New London-Niantic



Proposed Route 623 Waterford Cancer Center
Proposed Route 624 Flanders-Niantic

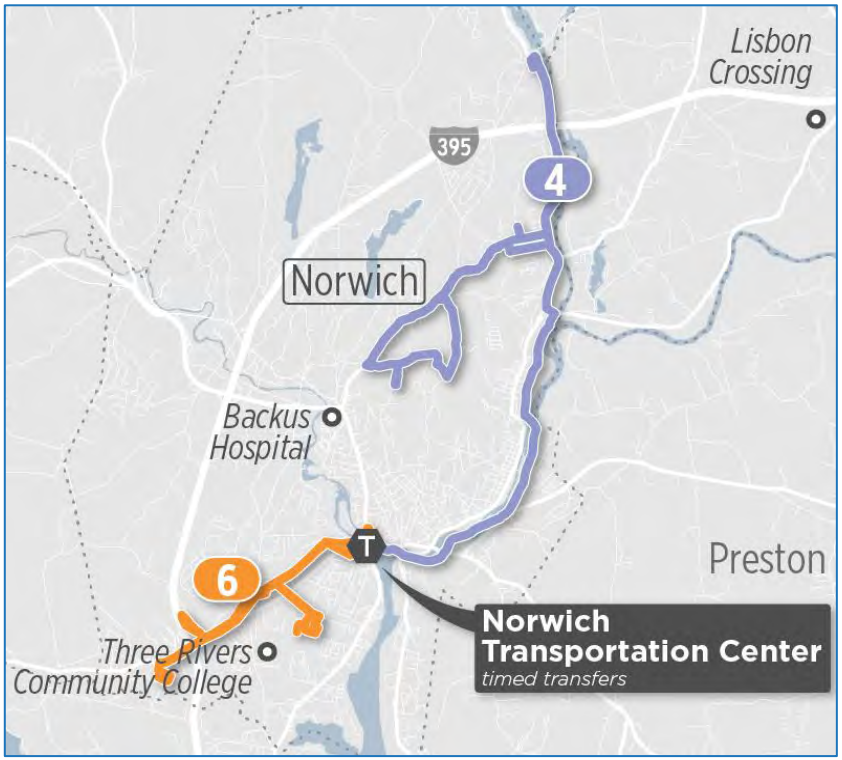
Route 623

- Route 623 provides a much faster connection between Union Station and Waterford Center, as opposed to current Run 3 which travels from Union Station to Groton prior to serving Waterford Center.
- End point would differ depending on whether Niantic service is retained.
  - If Niantic service is discontinued, Route 623 would operate New London-Waterford Center-Waterford Cancer Center.
  - If Niantic service is retained (as Route 624), Route 623 would terminate at Waterford Walmart, meeting Routes 624 and 621.

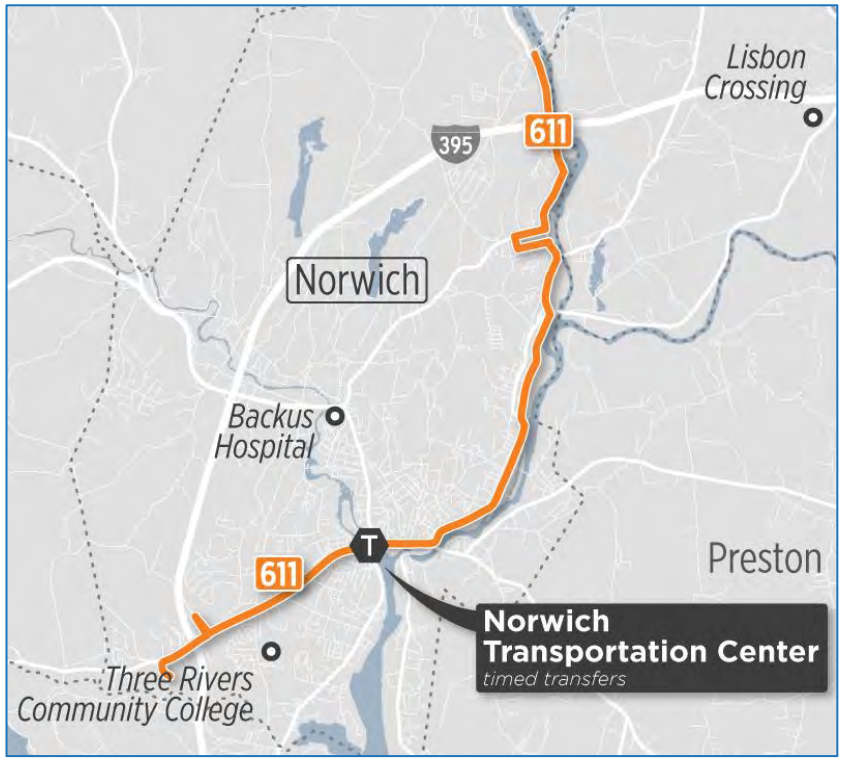
Route 624

- Service would operate directly between the Waterford Walmart-Flanders Four Corners-Niantic.

Run 4 Taftville-Occum-Greenville
Run 6 West Side



Proposed Route 611 West Main-Occum

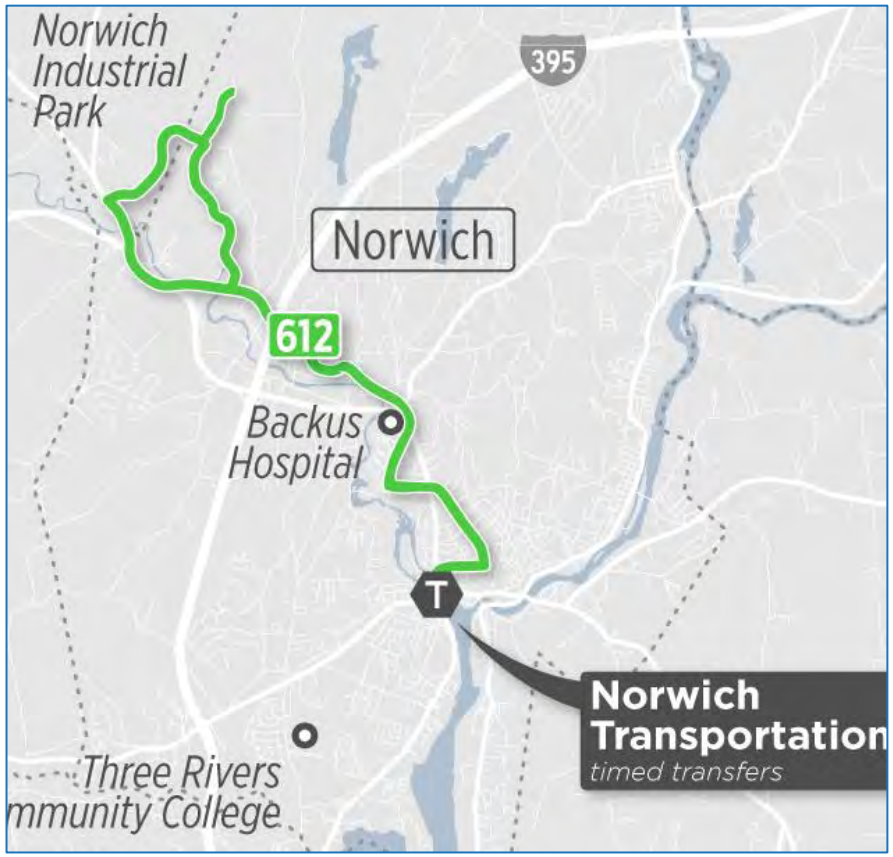


Route 611

- SEAT runs 4 and 6 would be combined to provide one-seat service between Occum, Taftville, Greenville, and Norwich's west side retail district.
- The Taftville deviation would be shortened, eliminating a long loop that carries very few riders. This allows for more frequent service to Occum.
- Wequonnec Village would no longer be directly served, riders would need to board the bus on Providence Street.
- All trips would operate via Boswell Avenue.
- On the west side, the Dunham Street Sunset Park area would be served by a new Route 610.

Run 5 Norwich Industrial Park

Proposed Run 612 Norwich Industrial Park

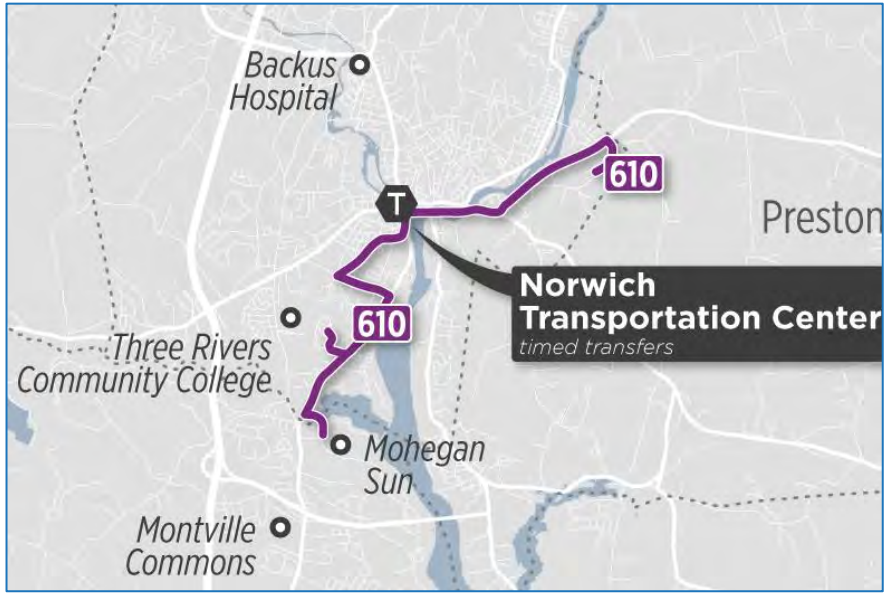


Route 612

- Service realigned to eliminate two of three one-way loops. The Industrial Park loop is shortened by bypassing unproductive segment on Otrobando Avenue.
- Service would operate northbound on Broadway and southbound on Union Street. Service would operate in both directions via Sachem Street and Lafayette Street.
- One or two daily trips would serve Wisconsin Avenue at the north end of the Industrial Park, rather than the Industrial Park loop.

Run 7 Hamilton Avenue-Mohegan Sun

Proposed Run 610 Hamilton Avenue-Mohegan Sun

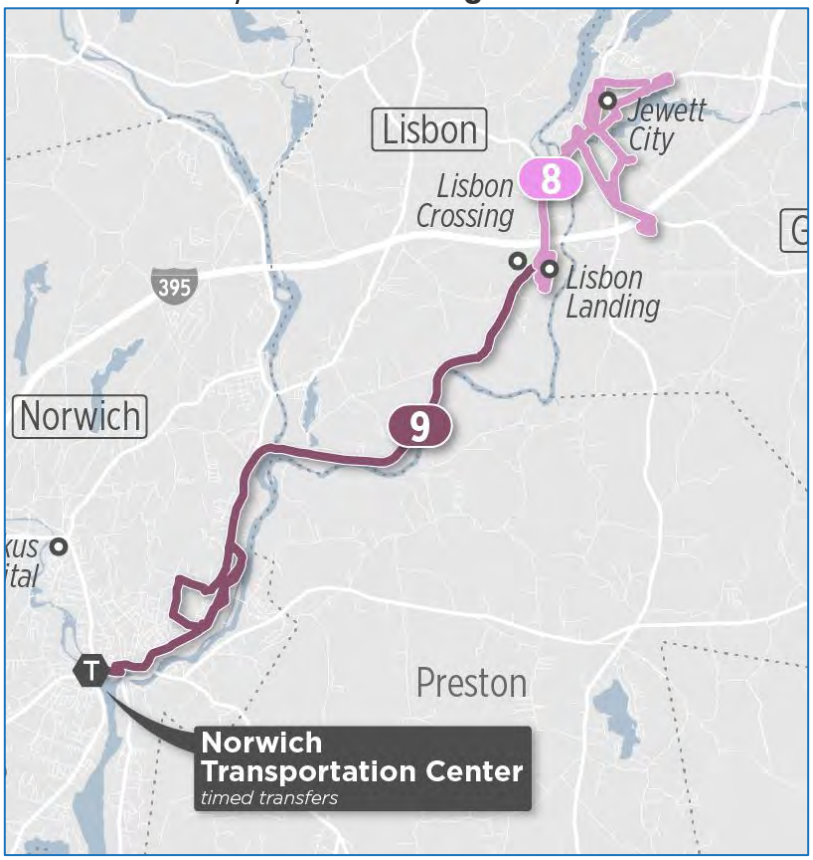


Route 610

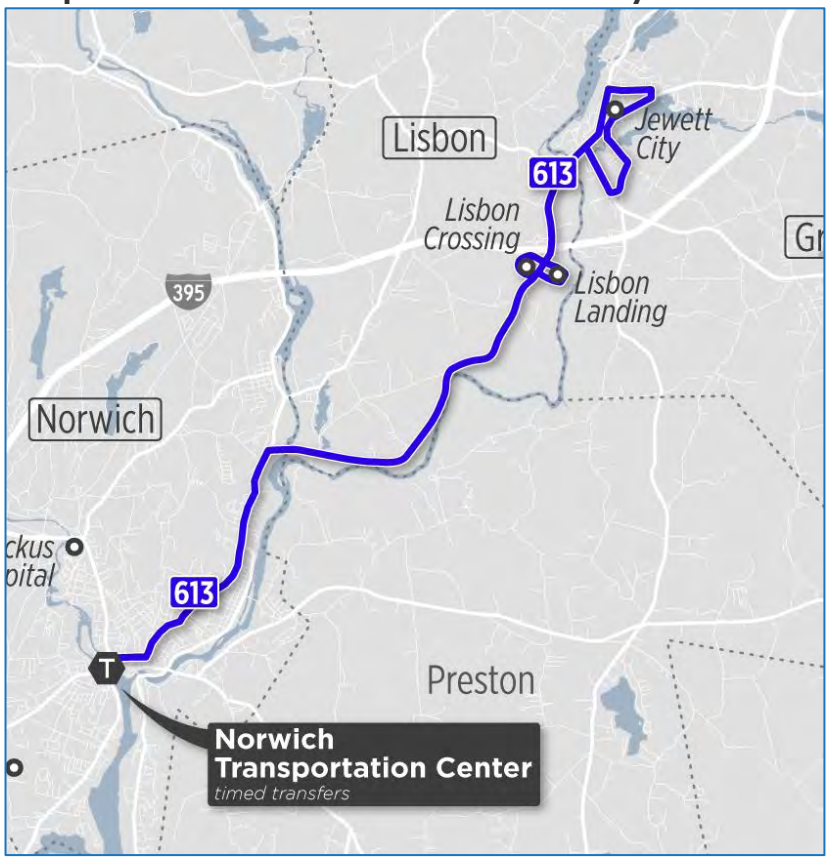
- Service would operate between Mohegan Sun, Sunset Park area, West Main Road, downtown Norwich, and Hamilton Avenue. The Greenville area along Central Avenue and Boswell would be served by Routes 611 and 613.
- The Franklin Street deviation in downtown Norwich would be discontinued due to low ridership.
- Route 610 would provide service to Uncas on Thames complex.

Run 8 Jewett City/Lisbon Landing

Run 9 Norwich/Lisbon Landing



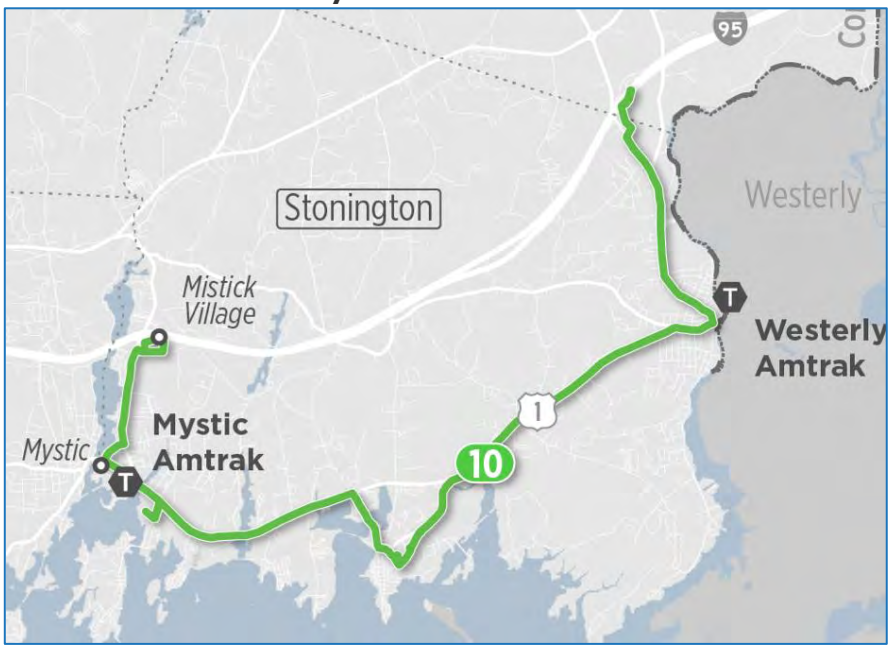
Proposed Route 613 Norwich-Jewett City



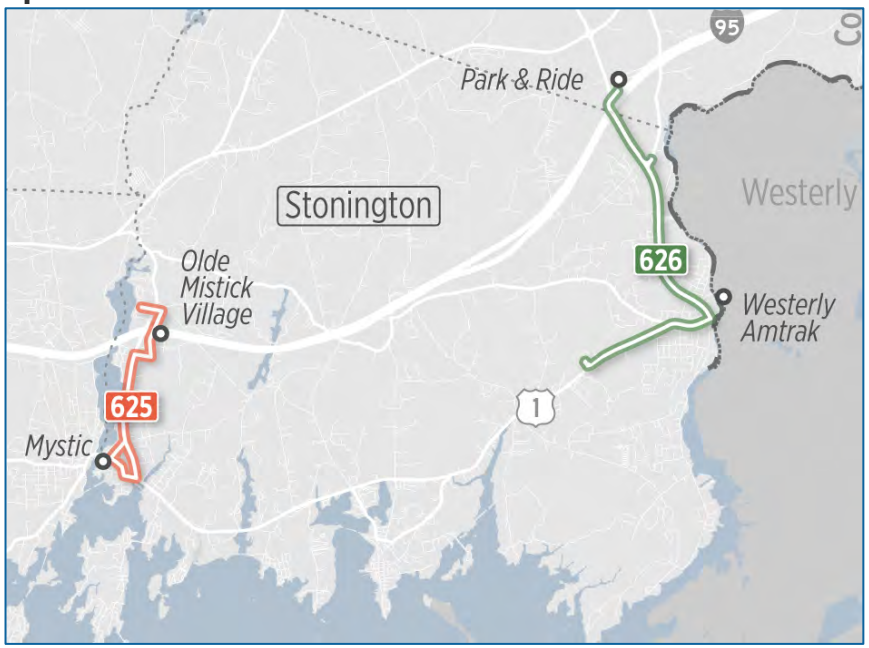
Route 613

- SEAT runs 8 and 9 would be combined to provide one-seat service between Norwich, Lisbon, and Jewett City.
- Route 613 would serve both Lisbon Landing and Lisbon Crossing.
- Meandering service in Jewett City would be straightened to make route faster and easier to understand.
- All trips would operate via Boswell Avenue in Norwich.

Run 10 Pawcatuck Mystic



Proposed Route 625 Mystic Shuttle
Proposed Route 626 Pawcatuck Local



Route 625

- The Mystic portion of Run 10 would be redesigned as a seasonal shuttle operating between Olde Mistick Village and Mystic Center.
- The shuttle would operate more frequently (30 minutes versus every 2 hours).
- The shuttle would operate 7 days a week for 5 months, from mid-May to mid-October.
- Connections to New London and Foxwoods could be made at Olde Mistick Village.

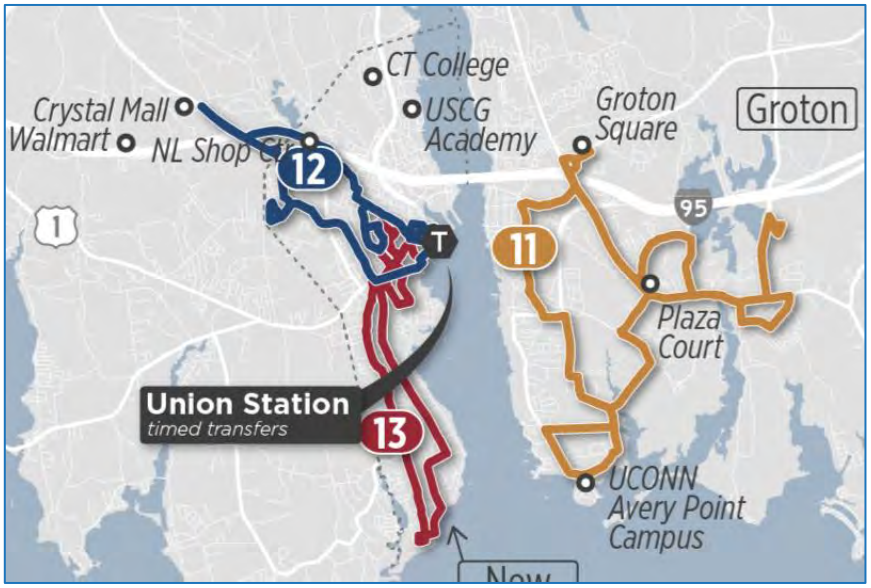
Route 626

- The Pawcatuck portion of Run 10 would operate between Brookside Apartments to the park-and-ride lot on SR 2 at I-95.
- Route 626 would serve the Voluntown Road Stop & Shop.
- Connections to Foxwoods, Olde Mistick Village, and New London could be made at the park-and-ride lot.

Run 11 Groton Local

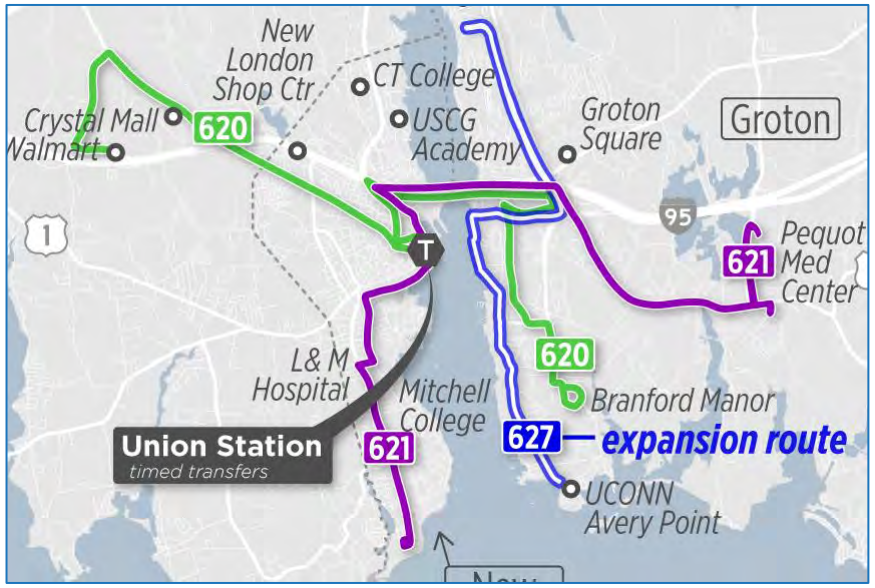
Run 12 Jefferson Ave/Malls

Run 13 L+M Hospital/Ocean Beach



Proposed Route 620 Waterford /Branford

Proposed Route 621 Ocean Beach/Pequot Medical



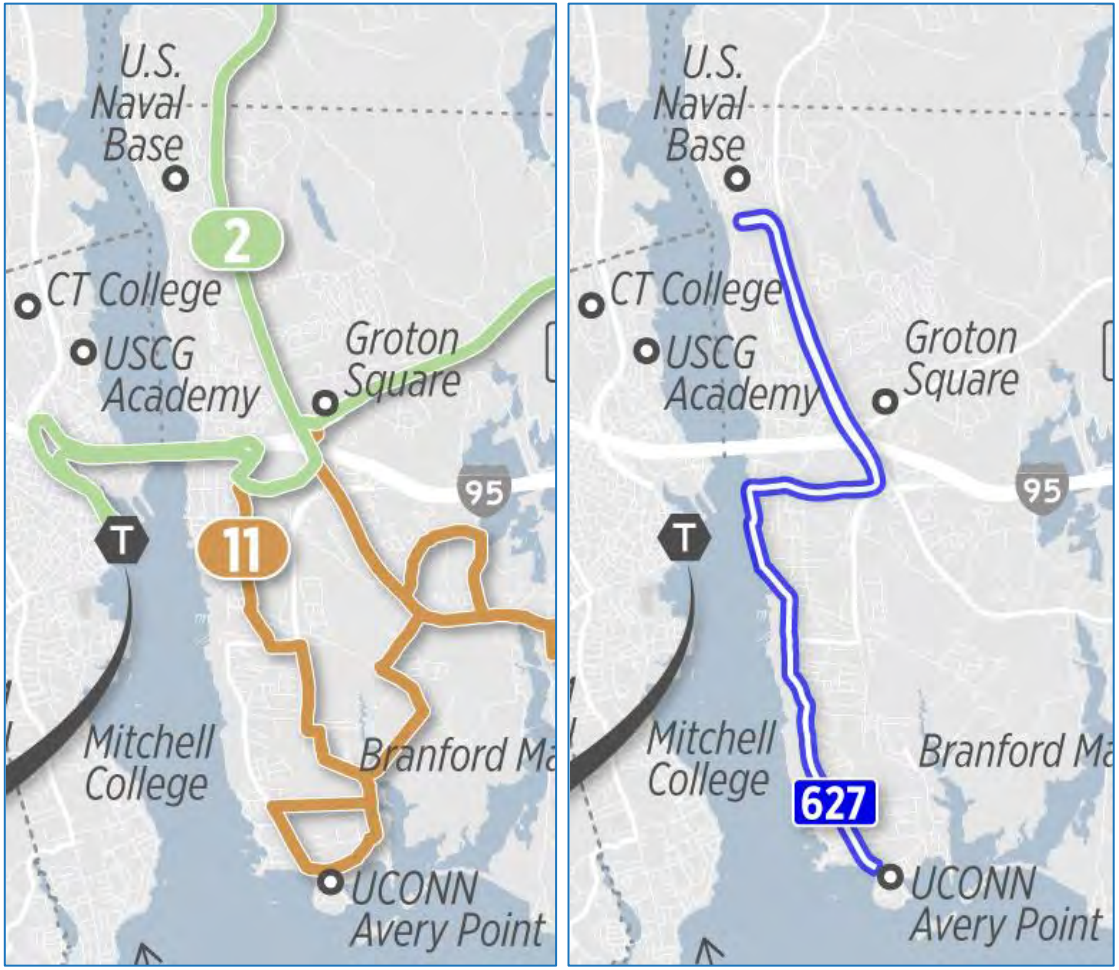
Route 620

- Runs 11 & 12 combined to offer one-seat service between Groton and Waterford.
- Waterford leg would extend to Walmart. Groton leg would end at Branford Manor.
- Local Groton connections could be made at a new Groton Square mini-hub.
- Service to Avery Point would be discontinued.

Route 621

- Runs 11 & 13 combined to offer one-seat service between Pequot Medical Center and Ocean Beach.
- Groton leg would serve Poquonnock Bridge area in one direction. Poquonnock Road south of Route 1 would be discontinued due to low ridership.
- Ocean Beach service would operate on Ocean Avenue in two directions.

Proposed New Route 627 Avery Point-US Naval Base



Route 627

- This new Groton local route would connect UCONN Avery Point, GD-Electric Boat, Groton Square, and the US Naval Base.
- Connections to other Groton locations, Norwich, Foxwoods, and New London could be made at Groton Square.

Run 14 Crystal Ave/Malls/Coleman

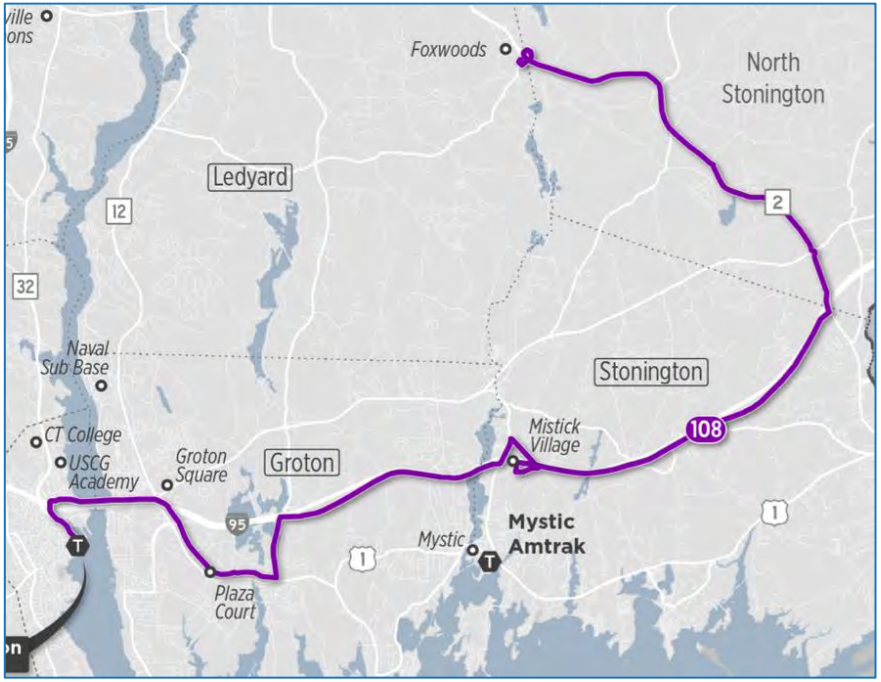
Run 15 New London/Waterford Evening Service

Proposed Route 622 New London

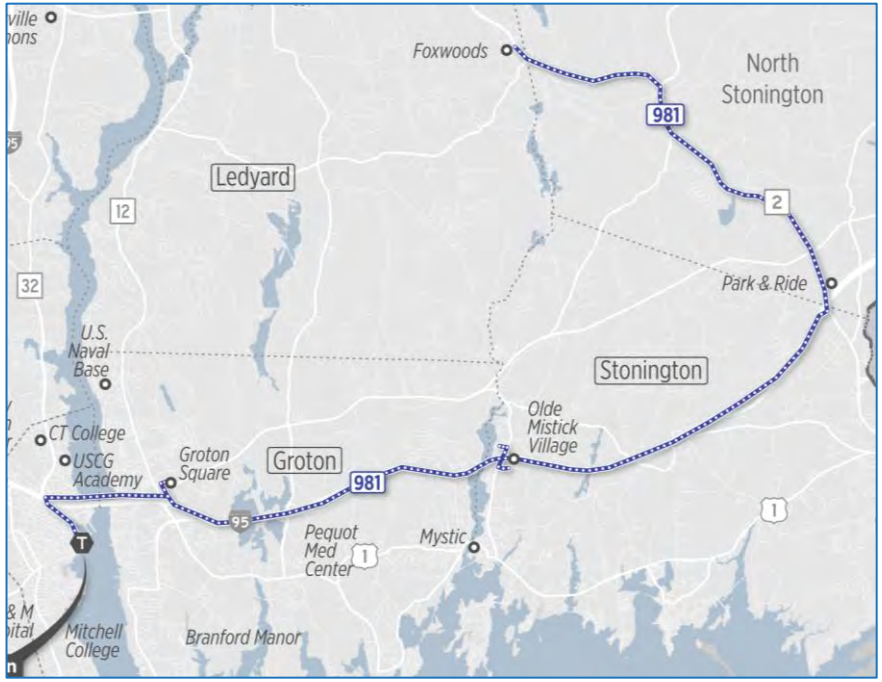
Route 622

- Existing Run 14 would be simplified to eliminate deviations and loops.
- Service would operate northbound on Jefferson and southbound on Coleman.
- Service would connect Bank Street and New London neighborhoods directly with the New London Mall and New London Shopping Center.

Run 108 New London/Foxwoods



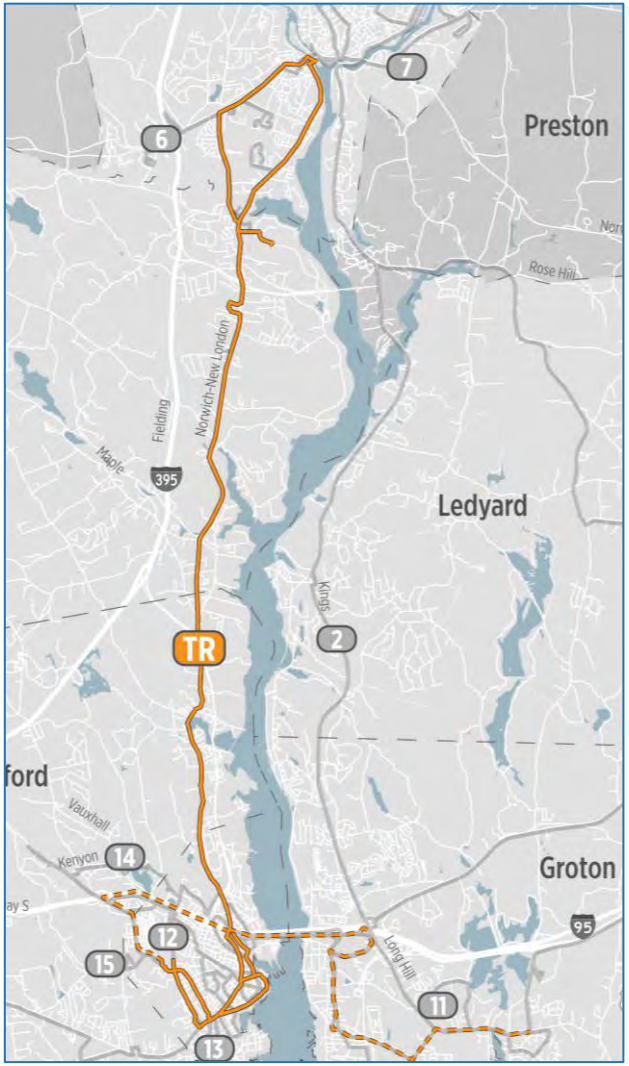
Proposed Route 981 New London/Foxwoods



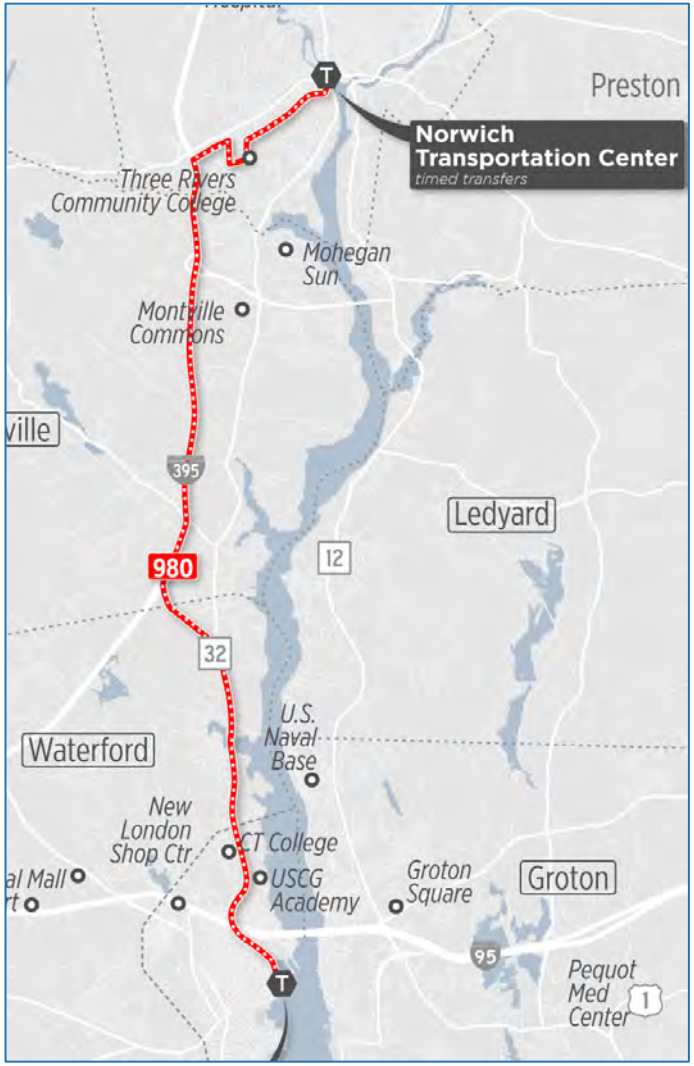
Route 981

- Existing Run 108 would be refocused on highway segments, providing faster travel between New London and Foxwoods.
- Travel between New London and Foxwoods would be 10 minutes faster.
- Groton residents can make connections at Groton Square.

TR Three Rivers Express



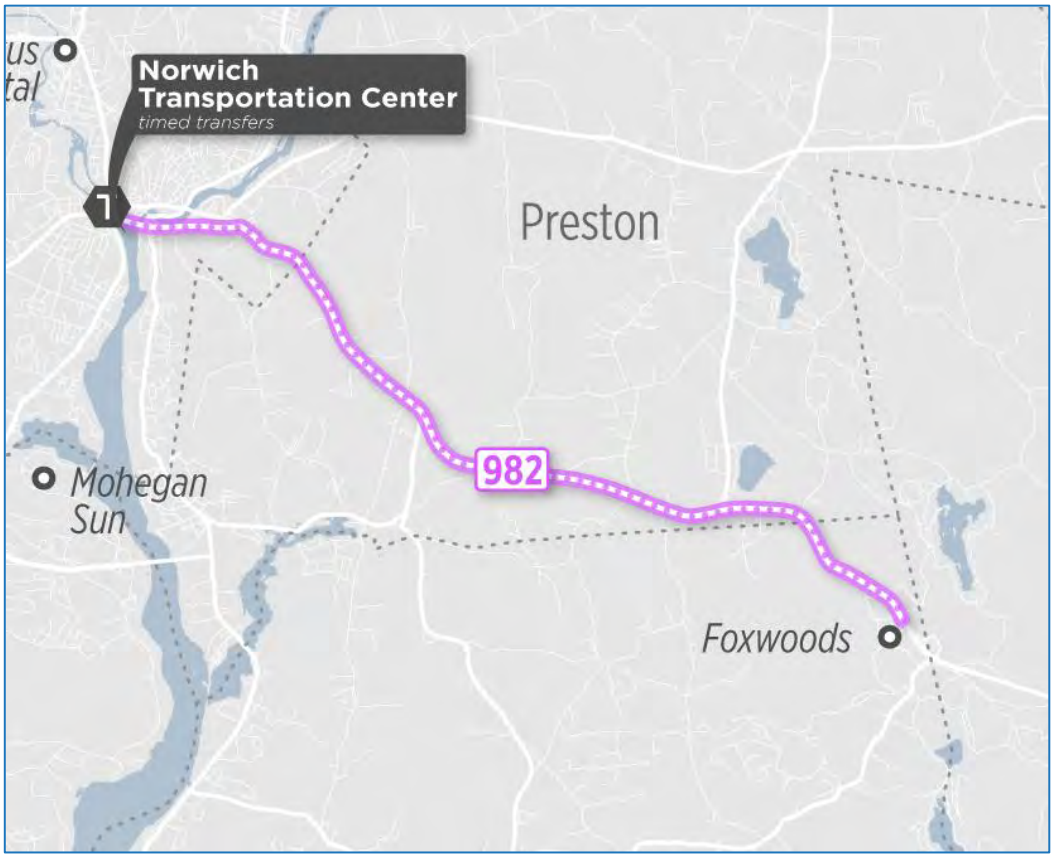
Proposed Route 980 New London/Norwich Express



Route 980

- Today SEAT operates 7 daily trips between New London and Three Rivers Community College.
- Route 600 (described earlier) would provide direct service between New London and TRCC all day.
- Route 980 would provide supplemental express trips, traveling via I-395 and arriving in 30 minutes rather than 60 minutes.
- Express service would be initiated between New London and TRCC, and would alternate with Norwich Transportation Center trips as more service can be added.
- Groton residents can use Routes 620, 621 or 981 to access TR trips at Union Station.

Proposed New Route 982 Norwich – Foxwoods Express



Route 982

- This new route would provide service between the Norwich Transportation Center and Foxwoods Resort Casino.
- The route would operate as an express on Route 2 in Preston, but would serve the Tanger Outlet Mall in Mashantucket.

DESCRIPTION OF PLANS

The improvement plans were created by combining the route design improvements described above with potential changes to service span (length of service day) and frequency. While alignment changes to existing routes were designed to be implemented without impact to operating costs, span and frequency changes would directly impact the cost of service. For this reason, three alternative plans have been developed:

- Two "Cost Neutral plans" that focus mainly on route and alignment changes
- A third "System Expansion plan" that also incorporates a range of span and frequency improvements to enhance the attractiveness and availability of transit

Finally, a number of related capital and operational improvements are proposed to enhance the system as a whole. These improvements are intended to improve service reliability and to make the system easier to understand and use, and may have associated capital or operating costs. However, they can be implemented as resources allow, and would support any of the three plans considered.

Cost Neutral Plan A

The first plan focuses SEAT resources on areas where ridership demand is the greatest. It is cost neutral on a systemwide basis.

Cost Neutral Plan A incorporates alignment changes on almost all existing SEAT runs, implementing transit design principles to make service faster, more reliable, and more efficient. It also discontinues two existing SEAT runs (in Stonington and East Lyme) that carry very few riders today. These resources would be redirected to frequency improvements in the Route 600/980 corridor between New London and Norwich, providing hourly service to better serve existing riders, improve regional mobility, and attract more riders.

Figure 9 provides a map of Cost Neutral Plan A. In addition, Figure 10 provides a list of services offered under this option and the associated span and frequency of each.

FIGURE 9 COST NEUTRAL PLAN A

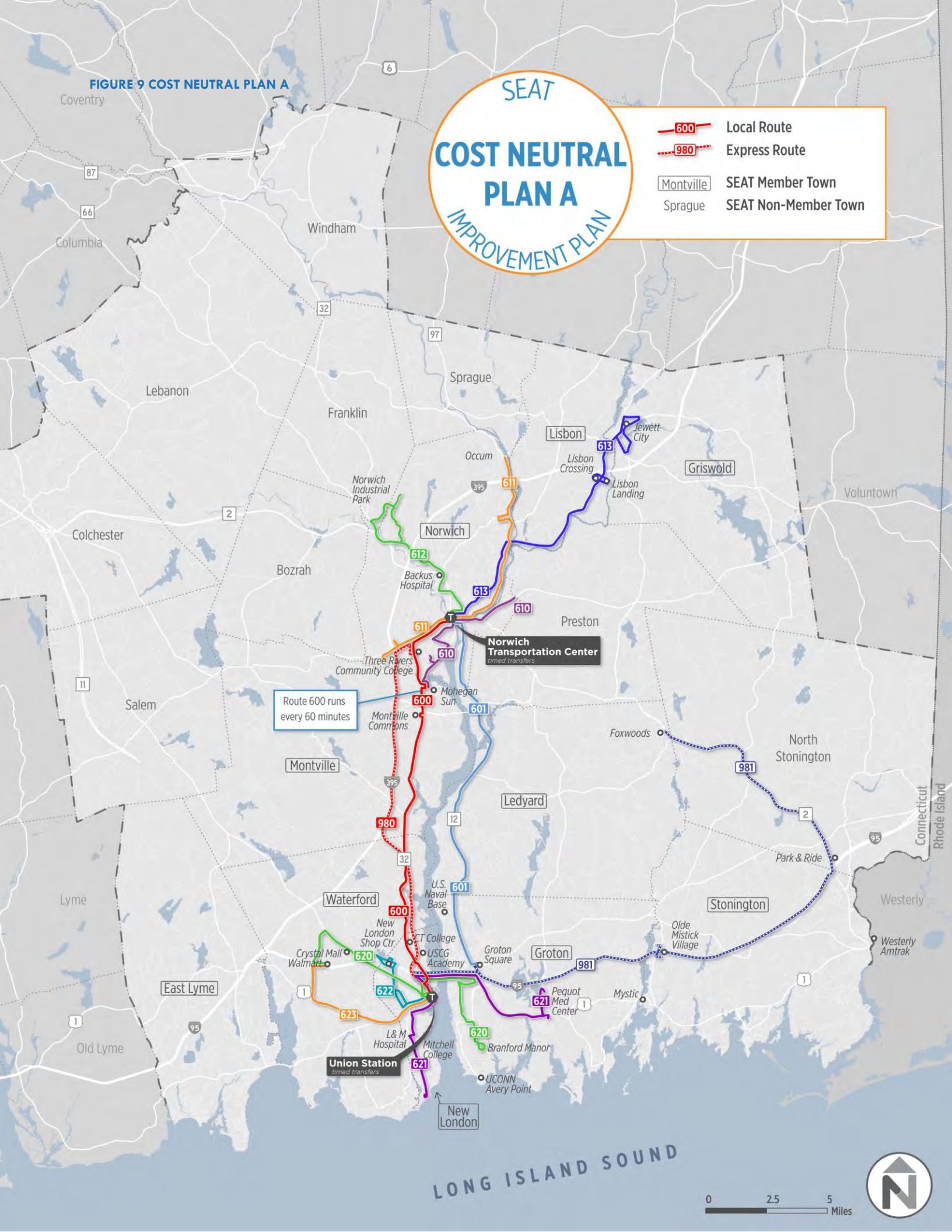


FIGURE 10 SPAN & FREQUENCY OF SERVICE UNDER COST NEUTRAL PLAN A

	WEEKDAY		SATURDAY		SUNDAY	
	Service Span	Frequency	Service Span	Frequency	Service Span	Frequency
600 Norwich–New London (previously Runs 1 & 101)	6AM – 5PM 5PM – 11PM	60 min 120 min	6AM – 11PM	120 min	7AM – 2PM	120 min
601 Norwich–Groton (former Run 2)	8AM – 5PM	120 min	no service		no service	
612 Industrial Park (former Run 5)	8AM – 6:30PM	60 min	9AM – 5:30PM	60 min	no service	
611 West Main–Occum (previously Runs 4 & 6)	6:30AM – 7PM	60 min	6:30AM – 7PM	60 min	no service	
610 Mohegan Sun–Hamilton (previously Run 7)	6AM – 11PM	60 min	6AM – 10PM	60 min	6AM – 2PM	60 min
613 Jewett City (previously Runs 8 & 9)	6AM – 10PM	60 min	6AM – 10PM	60 min	no service	
620 Broad Street–Groton (previously Runs 11 & 12 & 15)	7AM – 10:30PM (west side only after 8PM)	60 min	7AM – 10:30PM	120 min	6AM – 2PM (Groton only)	60 min
621 Ocean Beach–Groton/Pequot Med (previously Runs 11 & 13 & 15)	7AM – 7:30PM	60 min	7AM – 7:30PM	120 min	6AM – 2PM (Groton only)	60 min
622 New London (former Runs 14/15)	7:30AM – 10PM	60 min	7:30AM – 10PM	60 min	no service	
623 Waterford (former Run 3)	8AM – 5PM	120 min	no service		no service	
980 Norwich–New London Express (previously Three Rivers Shuttle)	6 one-way trips daily		no service		no service	
981 New London–Foxwoods Express (previously Run 108)	6AM – 11PM	120 min	6AM – 10PM	120 min	6AM – 2PM	120 min

Green = Better than today

Red = Worse than today

Cost Neutral Plan B

The second plan is designed to retain transit coverage in all SEAT member communities, providing access across a larger service area, including areas of lower density. It is cost neutral on a systemwide basis. Because it would not discontinue service to any existing SEAT communities, the SEAT Board of Directors has expressed their preference for this plan.

Cost Neutral Plan B incorporates alignment changes on all existing SEAT runs, implementing transit design principles to make service faster, more reliable, and more efficient. It does not include any span or frequency improvements. Modified services in Stonington (Route 626) and East Lyme (Route 624) would be retained to provide a minimal level of service to residents of these communities. The level of service within the Route 600/980 corridor between Norwich and New London would also continue to operate every two hours, as it does today.

Figure 11 provides a map of Cost Neutral Plan B. In addition, Figure 12 provides a list of services offered under this option and the associated span and frequency of each.

FIGURE 11 COST NEUTRAL PLAN B

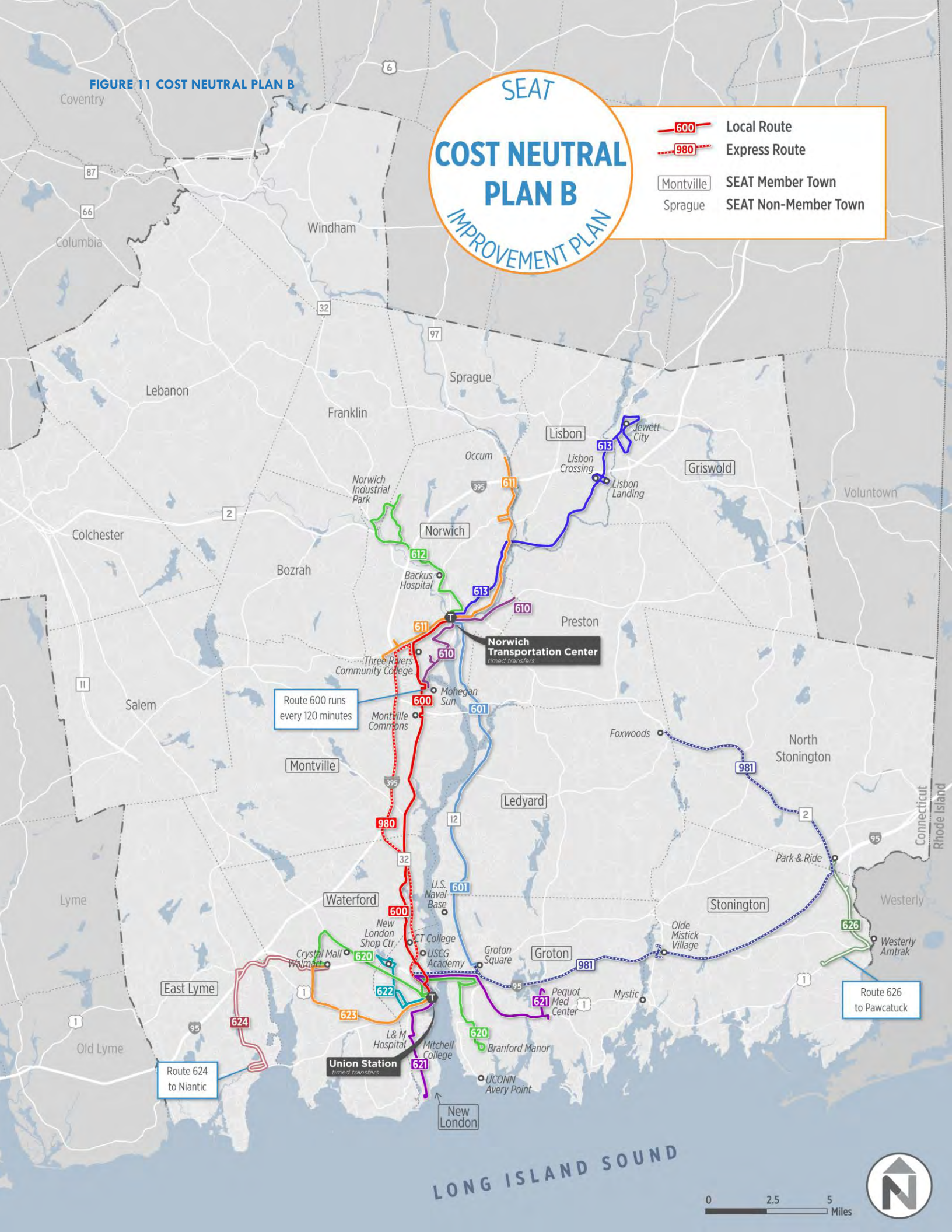


FIGURE 12 SPAN & FREQUENCY OF SERVICE UNDER COST NEUTRAL PLAN B

	WEEKDAY		SATURDAY		SUNDAY	
	Service Span	Frequency	Service Span	Frequency	Service Span	Frequency
600 Norwich–New London (previously Runs 1 & 101)	6AM – 11PM	120 min	6AM – 11PM	120 min	7AM – 2PM	120 min
601 Norwich–Groton (former Run 2)	8AM – 5PM	120 min	no service		no service	
612 Industrial Park (former Run 5)	8AM – 6:30PM	60 min	9AM – 5:30PM	60 min	no service	
611 West Main–Occum (previously Runs 4 & 6)	6:30AM – 7PM	60 min	6:30AM – 7PM	60 min	no service	
610 Mohegan Sun–Hamilton (previously Run 7)	6AM – 11PM	60 min	6AM – 10PM	60 min	6AM – 2PM	60 min
613 Jewett City (previously Runs 8 & 9)	6AM – 10PM	60 min	6AM – 10PM	60 min	no service	
620 Broad Street–Groton (previously Runs 11 & 12 & 15)	7AM – 10:30PM (west side only after 8 pm)	60 min	7AM – 10:30PM	120 min	6AM – 2PM (Groton only)	120
621 Ocean Beach–Groton/Pequot Med (previously Runs 11 & 13 & 15)	7AM – 7:30PM	60 min	7AM – 7:30PM	120 min	6AM – 2PM (Groton only)	120
622 New London (former Runs 14/15)	7:30AM – 9PM	60 min	7:30AM – 9PM	60 min	no service	
623 Waterford (former Run 3)	8AM – 5PM	120 min	no service		no service	
624 Niantic (previously Run 3)	8AM – 4:30PM	120 min	no service		no service	
626 Stonington (former Run 10)	8:30AM – 5PM	60 min	no service		no service	
980 Norwich–New London Express (previously Three Rivers Shuttle)	6 one-way trips daily		no service		no service	
981 New London–Foxwoods Express (previously Run 108)	6AM – 11PM	120 min	6AM – 10PM	120 min	7AM – 2PM	120 min

Green = Better than today

Red = Worse than today

System Expansion Plan C

This plan could be implemented only if additional operating resources were identified to support SEAT. It includes all improvements in Plan A and Plan B, and also incorporates a wide range of service span improvements and three new routes.

This plan was developed in response to stakeholder and rider feedback, as well as the study team's evaluation of existing service and transit demand. Today, SEAT resources are spread across the service district, with most areas receiving limited service frequency and no Sunday service. With many people relying on SEAT to access work, school, and medical and social services, increased frequency and service span are critically needed.

System Expansion Plan C includes all improvements listed in Plan A and Plan B, including hourly frequency on Route 600 between Norwich and New London, and local routes serving Pawcatuck (626) and Niantic (624). In addition, this plan includes:

- Additional trips on 980 Norwich–New London Express
- Three new routes:
  - 625 Mystic Shuttle (seasonal)
  - 627 Avery Point–US Naval Base
  - 982 Norwich–Foxwoods Express
- Sunday service on a total of eight routes, as compared to four today
- Extended service (earlier AM or later PM) on weekdays and Saturdays on nine routes

FIGURE 13 SYSTEM EXPANSION PLAN C

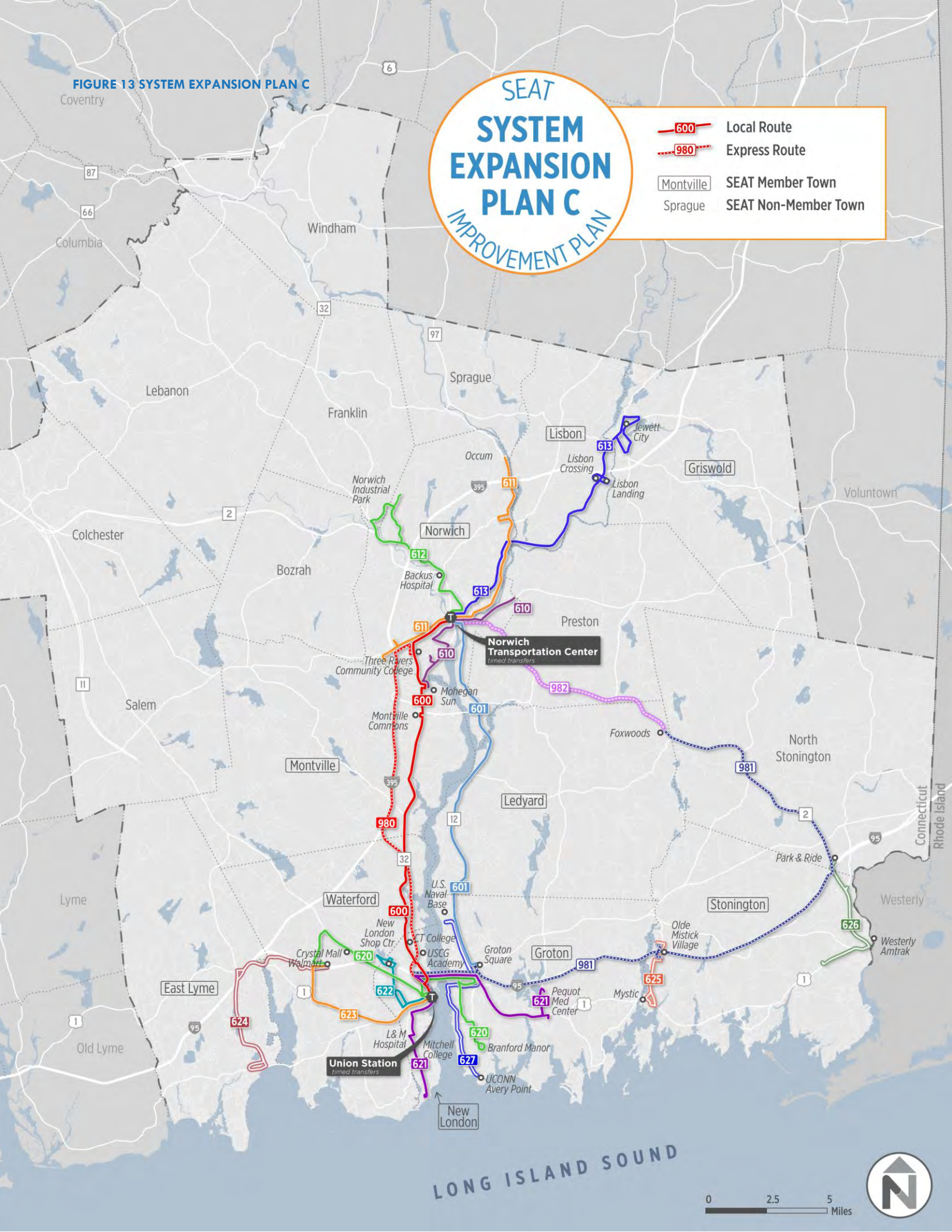


FIGURE 14 SPAN & FREQUENCY OF SERVICE UNDER SYSTEM EXPANSION PLAN C

	WEEKDAY		SATURDAY		SUNDAY	
	Service Span	Frequency	Service Span	Frequency	Service Span	Frequency
600 Norwich–New London (previously Runs 1 & 101)	6AM – 7PM 7PM – 11PM	60 min 120 min	6AM – 11PM	120 min	7AM – 5PM	120 min
601 Norwich–Groton (former Run 2)	7AM – 6PM	120 min	8AM – 5PM	120 min	no service	
612 Industrial Park (former Run 5)	7AM – 6:30PM	60 min	7AM – 5:30PM	60 min	no service	
611 West Main–Occum (previously Runs 4 & 6)	6:30AM – 8PM	60 min	6:30AM – 8PM	60 min	8AM – 4PM	120 min
610 Mohegan Sun–Hamilton (previously Run 7)	6AM – 11PM	60 min	6AM – 10PM	60 min	6AM – 5PM	60 min
613 Jewett City (previously Runs 8 & 9)	6AM – 10PM	60 min	6AM – 10PM	120 min	no service	
620 Broad Street–Groton (previously Runs 11 & 12 & 15)	7AM – 11PM (west side only after 8 pm)	60 min	7AM – 10:30PM	120 min	8AM – 4PM (Groton and New London)	120 min
621 Ocean Beach–Groton/Pequot Med (previously Runs 11 & 13 & 15)	7AM – 8PM	60 min	7AM – 8PM	60 min	8AM – 4PM (Groton and New London)	120 min
622 New London (former Runs 14/15)	7:30AM – 10PM	60 min	7:30AM – 10PM	60 min	8AM – 4PM	60 min
623 Waterford (former Run 3)	7AM – 6PM	120 min	8AM – 5PM	120 min	no service	
624 Niantic (previously Run 3)	7:30AM – 5:30PM	120 min	no service		no service	
625 Mystic Shuttle (former Run 10)	8AM – 6PM	30 min	8AM – 6PM	30 min	8AM – 4PM	30 min
626 Stonington (former Run 10)	6:30AM – 5PM	60 min	no service		no service	
627 Groton: Avery Point - Naval Base	7AM – 5PM	60 min	no service		no service	
980 Norwich–New London Express (previously Three Rivers Shuttle)	8 trips TRCC; 8 Trips NITC		no service		no service	
981 New London–Foxwoods Express (previously Run 108)	6AM – 11PM	120 min	6AM – 11PM	120 min	6AM – 4PM	120 min
982 Norwich–Foxwoods Express	7:30AM – 5:30PM	120 min	no service		no service	

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Red = Worse than today

RELATED SYSTEMWIDE IMPROVEMENTS

A number of systemwide improvements have also been identified. These improvements work with any service improvement alternative and have the potential to further enhance SEAT operating performance, convenience, and customer satisfaction.

Create Bus Stops / Discontinue Flag Stop System

Many riders find the flag stop system confusing, and SEAT drivers have indicated that flag stops slow service and affect on-time performance. Discontinuing the flag stop system should improve the efficiency of service.

Using ridership data now collected through its Automated Passenger Count (APC) system, SEAT can identify locations for permanent bus stops and add specific timepoints to its schedules. Bus stop signs would need to be installed, and any rural route segments where SEAT might still operate under a flag stop system should be clearly identified on its route maps. Key locations with high ridership or where two routes intersect should be considered for bus shelters, seating, bus schedule information and/or signage highlighting the availability of transit.

Make Hub/Facility Improvements

Bus hubs are an important part of a local transit system, providing highly visible locations and a higher level of passenger amenities to attract customers, as well as a location to make connections and transfers. The following improvements to existing SEAT hubs are suggested:

- **Install berth signage at Norwich Intermodal Transportation Center (NITC).** Bus berths at NTC are unassigned and passengers are not always sure where to stand while waiting for buses to arrive/depart on each hourly pulse. General berth assignment and signage (e.g. three routes assigned to inner bay berths and three to outer bay berths) would improve this situation.
- **Work with New London to Improve Union Station Intermodal Hub.** Union Station is an important intermodal hub, yet SEAT bus berths have limited space and poor pedestrian access. SEAT should coordinate with local planners, SCCOG, and others involved in planning for the new National Coast Guard Museum to identify improvements to better accommodate local buses and riders in this area. Enhancements could include shelters, berth signage, real-time information displays, route maps, and seating.
- **Create a new Groton Square Mini-Hub.** Four SEAT routes are proposed to meet in the Groton Square area. Coordination with the shopping center owners is recommended to properly site a location for bus transfers and layover, as well as passenger amenities such as a shelter and real time information display.

Make BRT Type Improvements Between Norwich and New London

Route 600 would function as the primary route in SEAT's system, connecting the urban centers of New London and Norwich and providing access to regional services, schools, and employment opportunities. Improvements should be made to ensure fast, frequent service and to attract new riders. In particular, transit signal priority would help improve speed and reliability by maintaining green traffic signals for SEAT buses. Queue jump lanes at intersections would also help the flow of buses. Other BRT type improvements might include designating limited key stops along SR 82 with branded passenger shelters, as well as designated berths in New London and Norwich.

Construct Pedestrian Improvements at Key Stop Locations

Due to the rural nature of the study area, many SEAT bus routes operate on state highways with high speeds and busy traffic. SEAT passengers must often cross these roadways in at least one travel direction. Crosswalks, signals, pedestrian islands, and other enhancements should be considered at key locations such as the State Correctional Center on SR 32, St. Bernard's High School, Three Rivers College, and major shopping centers.

Pursue Other Roadway Modifications that Support SEAT Service Efficiency

A number of locations have been identified where minor roadway improvements would enhance the efficiency of SEAT service. These include:

- A bus turnaround by the Hamilton Avenue Playground in Norwich, where SEAT Run 7 currently terminates near the border of the SEAT service area.
- A small widening of the main entryway circle at the Department of Social Services in the Uncas on Thames complex. This would facilitate the turning of buses within the main circle entry rather than traversing the entire complex to pick up a limited number of riders.

Other Related Improvements

Eliminate Multi-Zone Fare Structure

Stakeholders and SEAT bus drivers have also indicated that the multi-zone fare structure is confusing to riders and can be difficult to properly enforce. Due to these difficulties, the revenue impact of transitioning to one systemwide base fare should be assessed and considered for implementation.

Provide More Fare Payment Options

Stakeholders and riders expressed interest in having more options for fare payment, including unlimited monthly passes, student U-Passes that could be used over a semester, and reloadable passes. Riders would also find it helpful if SEAT fare products were sold at more locations.

Improve Public Information (Website, Maps, and Route Schedules)

Many SEAT customers have commented on the need for route maps and schedules that are easier to understand. The implementation of upcoming SEAT service changes provides the opportunity to adopt a new style and user-friendly format in tandem with these changes. These updates can also be implemented in step with other SEAT improvements (bus stops, real-time bus tracking apps, etc.) as part of a coordinated and thoughtful update of the overall SEAT brand, including the website, schedules, and route maps.

Shift Systemwide Pulses

Today, buses meet at the Norwich Transportation Center and New London Union Station every hour, "on the hour" allowing customers to transfer between routes. If these connections were shifted to occur "on the half hour," it would give many workers time to get to jobs with shifts that begin "on the hour." Another consideration would be to shift only one of the pulses (e.g. Norwich) to "on the half hour" once 30-minute express service on Route 980 becomes more frequent. This would allow commuters to leave one hub and make a connection at the other 30 minutes later.

Work with CTDOT to Implement or Strengthen Regional Connections

Recent statewide studies and discussions have suggested improved regional transit connection. Riders are also interested in strengthening regional connections and specifically mentioned a number of communities that are currently served by other transit districts, including:

- New London–Old Saybrook (9 Town Transit)
- Norwich–Willimantic (Windham Region Transit)
- Norwich–Colchester (CT*transit* Hartford division)
- Stonington–Westerly, RI (RI Public Transit Authority)

4 EVALUATION OF IMPROVEMENT PLANS

Evaluation Criteria

Each alternative plan has been evaluated against a range of criteria to compare the relative costs and benefits of each option. These criteria include ridership, operating costs, capital costs and other factors. The results of this evaluation are summarized below, including the methodology and assumptions made as part of this analysis.

Ridership & Fare Revenue

A major focus of the SEAT Bus Study has been to identify more compelling service alternatives to attract more riders to the system. Ridership demand was estimated for each plan based on existing SEAT ridership, accounting for individual route changes, the amount of service that would be provided under each alternative, and the improvements that would be made to service design.

Potential ridership was estimated based on current average weekday ridership, and then applying changes to route mileage, travel time, hours of service, and route simplification. This yielded a percentage increase under each plan, which was then applied to SEAT's actual FY14 ridership (1,165,424) t0 determine estimated annual ridership. An estimate of potential fare revenue was also made for each plan, calculated by applying the percentage increase in ridership to SEAT's total FY14 fare revenue ($951,167). The final estimates are presented in Table 2.

Based on improvements to the directness of route alignments, travel time, and the amount of service provided, Cost Neutral Plan A has the potential increase ridership by 16% without increasing operating costs. Cost Neutral Plan B would yield a smaller but still significant increase of 13%. System Expansion Plan C has the potential to yield even greater increases in ridership, due to the increased amount of service on existing routes as well as the addition of new routes. The potential for growth in ridership also translates to increased fare revenue under all three plans.

TABLE 2 ESTIMATED RIDERSHIP & FARE REVENUE

RIDERSHIP AND FARE REVENUE	EXISTING SEAT (FY14)	COST NEUTRAL A	COST NEUTRAL B	SYSTEM EXPANSION C
% Increase in Ridership	-	16%	13%	28%
Estimated Annual Ridership	**1,165,424**	**1,350,118**	**1,316,212**	**1,496,458**
Estimated Annual Fare Revenue	**$0.95 M**	**$1.10 M**	**$1.07 M**	**$1.22 M**

Annual Operating Cost Impacts

Revenue Hours of Service

The cost of providing SEAT services is a function of the number of revenue vehicle hours (RVH) and revenue vehicle miles (RVM) operated each day, as well as other factors such as administrative functions and ADA service. An operating cost model was developed based on the total RVH for each plan, as this is

the most significant factor related to the cost of service. The percentage increase was then applied to SEAT's FY16 approved operating budget of $6.26M to estimate the increased budget needed to support each alternative.

As shown in Table 3, the Cost Neutral A and B plans would involve minor increases in overall hours of service when compared to the 64,439 hours of service to be operated by SEAT in FY16. The System Expansion Plan C would involve an increase of 25.7% for full implementation.

TABLE 3 ESTIMATED COST OF PROVIDING SERVICE

COST OF SERVICE	EXISTING SEAT (FY16)	COST NEUTRAL A	COST NEUTRAL B	SYSTEM EXPANSION C
Annual RVH	64,439	64,541	64,587	81,005
Increase in RVH	-	102	148	16,566
% Increase in Cost of Service	**-**	**0.2%**	**0.2%**	**25.7%**
Est. Increase in Cost of Service[1]		**$10,000**	**$14,000**	**$1.61M**

1. Increase in Operating Cost is an order of magnitude estimate based on ratio of existing RVH to total operating costs, and includes non-service costs such as administration and vehicle maintenance.

ADA Paratransit Service Impacts

SEAT contracts with the Eastern Connecticut Transportation Consortium (ECTC) to provide complementary paratransit to those who are unable to ride fixed-route services. ADA paratransit service is provided to eligible individuals living within ¾ of a mile of SEAT fixed-route services during the same times of day. Changes to fixed-route alignments and service hours will impact the number of complementary paratransit trips provided.

Based on an interview with ECTC in December 2014, there are about 140 individuals living within ¾ of a mile from SEAT routes that are eligible for ADA service. This works out to about one individual per route mile of existing service. ECTC provides about 500 ADA rides per month, or an average of 3.5 per individual, with an average cost of about $30 per trip. The number of potential new ADA riders and trips was estimated based on these averages.

Due to the proposed discontinuation of routes and/or route segments in the Cost Neutral Plans, the table below shows there could potentially be a savings in ADA service costs under these alternatives. However, SEAT has indicated it may consider "grandfathering" clients in these areas to ensure no loss of service. If this policy were enacted, there would be no cost savings under the cost neutral options.

TABLE 4 ESTIMATED IMPACT ON ADA PARATRANSIT SERVICE

ADA IMPACT	EXISTING SEAT	COST NEUTRAL A	COST NEUTRAL B	SYSTEM EXPANSION C
Total Route Miles[1]	169	136	149	185
Est. ADA Customers[2]	140	113	124	154
Total Annual ADA Trips[2]	5,880	4,746	5,208	6,468
Change in Annual ADA Service [4]	**--**	**($0.04M)**	**($0.02M)**	**$0.02M**
ADA Impacts w/ "Grandfathering"		**--**	**--**	**$0.02M**

1. One-way route miles based on length of each route; includes double counting where routes overlap.
2. Based on existing system, assumes less than one (0.83) ADA customer per route mile.
3. Assumes each customer takes 3.5 rides per month, or 42 rides per year.
4. Based on 2014 average of $30/trip.

Additional Maintenance Costs

As described below under Capital Cost Impacts, the number of buses needed would increase from 17 to 22 vehicles under the System Expansion Plan C, necessitating an increase in the size of SEAT's fleet and an increase in vehicle maintenance. However, the cost to cover additional maintenance technicians is included in the overall increased cost of service shown in Table 3.

Installation of bus stop signs and shelters throughout the system is also discussed below. This would add new tasks to maintenance and is not factored into the overall increased cost of service. It is assumed that two new maintenance staff, at a fully loaded annual rate of $60,000 each would be brought on to cover these duties.

TABLE 5 SUMMARY OF OPERATING & MAINTENANCE COSTS

OPERATING & MAINTENANCE ITEM	COST NEUTRAL A	COST NEUTRAL B	SYSTEM EXPANSION C
Increased Cost of Service	$0.01M	$0.01M	$1.61M
ADA Service Costs[1]	--	--	$0.02M
Bus Stop Maintenance	$0.12M	$0.12M	$0.12M
Subtotal Increased Operating Cost	$0.13M	$0.13M	$1.75M
Less Estimated Fare Revenue	$1.10 M	$1.07 M	$1.22 M
Net Increase Operating Costs	**($0.97M)**	**($0.94M)**	**$0.53M**

1. Assumes existing ADA customers would be grandfathered in, negating savings under Cost Neutral Plans.

Capital Cost Impacts

Acquire Needed Fleet for Expansion

Currently SEAT has a peak period vehicle requirement of 17 buses. The two cost neutral alternatives are designed to operate the same number of vehicles and keep operating costs consistent with today. Additional fleet would only be needed for system expansion. Future fleet procurement to support expansion would likely be for 35-foot diesel-electric hybrid vehicles, as currently programmed in the Statewide Transportation Improvement Program at a cost of $620,000 per bus.

TABLE 6 ESTIMATED FLEET EXPANSION COSTS

CAPITAL ITEM	UNIT COST	COST NEUTRAL A	COST NEUTRAL B	SYSTEM EXPANSION C
New Buses Needed		0	0	5
Fleet Expansion Costs	**$0.62 M/bus**	**$0**	**$0**	**$3.10M**

Create Bus Stops / Discontinue Flag Stop System

Designated bus stops should be spaced at consistent intervals and identified with SEAT bus stop signs. For the purposes of this analysis, it is assumed that bus stops would be placed, on average, every 880 feet across the system or an average of six stops per mile. It is likely that spacing might be closer in some urban areas and greater in rural areas. The flag system may also continue to be appropriate along certain rural stretches of road (such as SR 12 in Lisbon or parts of Ledyard).

Additionally, certain key stops would merit a passenger shelter with bench. These should be stops with higher levels of daily boardings (e.g. shopping centers, hospitals, and town centers) or locations where two bus routes intersect (e.g. Broad Street and Colman Street in New London). It is assumed there would be an average of two locations on each route where enhanced bus stops would be provided.

TABLE 7 ESTIMATED BUS STOP COSTS

CAPITAL ITEM	UNIT COST	COST NEUTRAL A	COST NEUTRAL B	SYSTEM EXPANSION C
Total Route Miles[1]	-	136 mi.	149 mi.	185 mi.
# of routes		12	14	17
Est. # New Bus Stops[2]	-	1,000	1,100	1,400
Cost for bus stop signs[2]	$500[3]	$0.50M	$0.55M	$0.70M
Cost for stops w/ shelter and bench	$15,000[4]	$0.36M	$0.42M	$0.51M
Bus Stop Implementation Costs	-	**$0.86M**	**$0.96M**	**$1.21M**

1. Represents total one-way mileage for all routes. Includes double-counting where routes overlap.
2. Assume 6 signs per mile, on both sides of each route. Estimate rounded down due to route overlap and rural areas.
3. Includes sign, pole and installation located, on average, every 1/6 mile throughout system.
4. Includes small shelter, bench and installation, on average, at 2 locations on every route in system

Make Hub/Facility Improvements

Improvements are suggested at two existing hubs, the Norwich Intermodal Transportation Center (NITC) and the New London Union Station Intermodal Hub. Cost for new berth signage at NITC and a new Groton Square mini-hub, with a large shelter and real time display, are included below. However, no costs are included for New London's Union Station since municipal coordination would be required to site and design bus facility improvements as part of the planned future National Coast Guard Museum.

TABLE 8 ESTIMATED COSTS TO IMPROVE TRANSIT HUBS

CAPITAL ITEM	UNIT COST	COST NEUTRAL A	COST NEUTRAL B	SYSTEM EXPANSION C
Berth Signage at NITC[1]	$20,000	$0.02M	$0.02M	$0.02M
Groton Square Mini-Hub[2]	$40,000	$0.04M	$0.04M	$0.04M
New London Union Station	*Facility planning required in order to develop cost estimate.*			
Hub Improvement Costs	-	**$0.06M**	**$0.06M**	**$0.06M**

1. Lump sum assumes 10 berth signs at $1,500/each, plus an overall facility berth map and wayfinding signage.
2. Lump sum based on Bus Rapid Transit stops in the Providence, RI area. Includes shelter, real time display, enhanced signage, bench and trash can.

Make BRT Type Improvements Between Norwich and New London

Extending green lights for transit buses approaching traffic signals along SR 82, SR 32, and in downtown New London could be achieved using a variety of technologies. It is assumed that transponders would be installed on both buses and in traffic signals; that transponders would be installed on all buses in the fleet to maintain operational flexibility; and that 40 intersections would be upgraded.

To further promote a higher level of service along Routes 600 and 980, it is assumed that 20 branded shelters would be installed and minor intersection improvements would be pursued to help the flow of buses.

TABLE 9 ESTIMATED COST OF BRT IMPROVEMENTS

CAPITAL ITEM	UNIT COST	ALL PLANS
Transit Signal Priority[1]		
- per vehicle (25)	$1,000	$0.03M
- per intersection[2] (40)	$30,000	$1.20M
Branded shelters/stops (20)	$30,000	$0.60M
Road/Intersection Improvements (LS)	$1.50 M	$1.50M
Design/Admin/Contingency (35%)	$0.75M	$1.20M
BRT Improvement Costs	-	**$4.50M**

1. TCRP Synthesis 83, Bus & Rail Transit Preferential Treatment (2010); NCHRP Research Digest 352 Cost Benefit Analysis on Converting a Lane to BRT (2011); and actual installation costs in Providence, RI (2013).
2. Assume 20 intersections along SR82 in Norwich, plus 20 along SR32 and in New London.

Construct Pedestrian Improvements at Key Stops

Crosswalks, signals, pedestrian islands, and other enhancements should be considered at key locations such as the State Correctional Center on SR 32, St. Bernard's High School, Three Rivers College, and major shopping centers. This could be achieved through the use of painted crosswalks, small island medians, pedestrian phases in the traffic signals, and other treatments. A lump sum of $750,000 has been included for these efforts.

Make Roadway Modifications to Support SEAT Service Efficiency

Two locations have been identified where minor roadway improvements would enhance the efficiency of SEAT service. A lump sum cost of $500,000 has been included to construct:

- A bus turnaround by the Hamilton Avenue Playground in Norwich, allowing Route 610 to terminate in this location.
- A small widening of the main entryway circle at the Department of Social Services in the Uncas on Thames complex. This would allow buses to turn within the main circle entry rather than traversing the entire complex to pick up a limited number of riders.

TABLE 10 SUMMARY OF CAPITAL COSTS

CAPITAL ITEM	COST NEUTRAL A	COST NEUTRAL B	SYSTEM EXPANSION C
Fleet Expansion	--	--	$3.10M
Bus Stop Implementation	$0.86M	$0.96M	$1.21M
Hub/Facility Improvements[1]	$0.06M	$0.06M	$0.06M
BRT Improvements: Norwich to NL	$4.50M	$4.50M	$4.50M
Pedestrian Improvements	$0.75M	$0.75M	$0.75M
Roadway Modifications	$0.50M	$0.50M	$0.50M
Est. Total Capital Cost Impact	**$6.70M**	**$6.80M**	**$10.12M**

1. Does not include the potential cost of future bus transit facility improvements at New London's Union Station.

Other Benefits

The number of passenger trips that are carried per bus service hour provides a measure of productivity in terms of how well existing service is used and, in many respects, how well it is designed. By providing

more direct and efficient service, SEAT's ridership per service hour is estimated to increase, particularly under the Cost Neutral Plans A and B. This indicates that the system will carry higher ridership within the same number of hours, making more productive use of the service that is already on the ground. In addition, SEAT can realize cost efficiency benefits under each plan: as ridership grows without a commensurate increase in operating cost, the system's cost per passenger will decline.

TABLE 11 SUMMARY OF PRODUCTIVITY METRICS

	EXISTING SEAT (FY14)	COST NEUTRAL A	COST NEUTRAL B	SYSTEM EXPANSION C
Annual Ridership	1,165,424	1,350,118	1,316,212	1,496,458
Annual Operating Cost	$6,262,788	$6,262,788	$6,262,788	$7,872,828
Annual Hours of Service	64,439	64,541	64,587	81,005
Passengers per Service Hour	**18.1**	**20.9**	**20.4**	**18.5**
Cost per Service Hour	**$97.19**	**$97.04**	**$96.97**	**$97.19**
Cost per Passenger	**$5.37**	**$4.64**	**$4.76**	**$5.26**

Finally, the improvements presented under all three plans provide additional benefits to the SEAT system and its users, including:

- **More Reliable Service.** In 2014, the average on-time performance of all SEAT routes was 58%, as compared to SEAT's established goal of achieving 90% on-time performance. Across all plans, improvements to service design that make routes more simple and direct will increase the likelihood that buses arrive on time and meet timed transfers ("pulses") at transfer centers, improve the reliability of service. Improved on-time performance and fewer missed connections will also make service more attractive to potential riders.
- **Stronger Regional Connections.** SEAT provides critical connections to major employers and regional activity centers. The recommendations in each plan strengthen these connections by providing more direct, consistent, and convenient service for riders to reach these employment, educational, and institutional centers.
  - **Plan A** will improve the frequency of service to Norwich, New London, Mohegan Sun, and Three Rivers Community College. It will also provide improved bi-directional service to the US Naval Base in Groton.
  - **Plan B** will continue to provide regional service to Pawcatuck and Niantic.
  - **Plan C** will provide the improved connections identified above, as well as new service between Norwich and Foxwoods Resort Casino, new service between Groton City and the US Naval Submarine Base, and a seasonal Mystic Village Shuttle.
- **Serving Minority and Low-Income Riders.** Under each plan, improvement options provide more and better service in many areas that have minority and low-income populations above the SEAT service area averages.

5 SUMMARY

Cost Neutral Plan A, as shown in Figure 1, best meets the established objectives of the SEAT Bus Study, which were to identify budget neutral service improvements that would better serve existing riders, improve the overall efficiency of SEAT operations, and attract more riders.

Improvements made under Plan A have the potential to increase ridership by 16%, leading to increased fare revenues and an overall anticipated net decrease in operating cost. Plan A also presents the lowest cost of associated capital improvements. Cost Neutral Plan B reduces these benefits somewhat, but may be preferred because it will maintain service to all SEAT communities.

TABLE 12 SUMMARY OF ALTERNATIVES EVALUATION

CRITERIA	COST NEUTRAL PLAN A	COST NEUTRAL PLAN B	SYSTEM EXPANSION PLAN C
Annual Increase Ridership	184,694 (16%)	150,788 (13%)	331,034 (28%)
Annual Increase Fare Revenue	$1.10 M	$1.07 M	$1.22 M
Net Annual Increase O&M Costs	($0.97M)	($0.94M)	$0.53M
Capital Cost Impact	$6.70 M	$6.80 M	$10.12 M
Passengers per Service Hour	20.9	20.4	18.5
Cost per Passenger	$4.64	$4.76	$5.26

In addition to the improvements that would result from implementing either Plan A or Plan B, it is clear that Plan C would have even more significant ridership benefits, with the potential to increase ridership by 28%. Although this alternative would result in somewhat lower overall passengers per service hour and cost per passenger, this is reflective of the additional late evening and weekend service that would be provided to increase overall rider mobility and access.

It is recommended that SEAT, working with SCCOG, take action to implement one of the **Cost Neutral Improvement Plans** for improved system efficiency over the near term. These partners should also pursue additional funding to implement the **System Expansion Plan** to better meet transit demand and mobility needs in the southeastern Connecticut region.

BENEFITS OF RECOMMENDED PLANS

- Easy to understand service
- Faster trips
- Fewer transfers
- Improved reliability
- Increased ridership
- Enhanced mobility

SEAT BUS STUDY

APPENDICES

SCCOG SEAT CONNECTICUT DEPARTMENT OF TRANSPORTATION

NELSON NYGAARD ASG PLANNING

APPENDICES

A. Transit Market Analysis

B. SEAT Run Evaluations

C. Summary of SEAT Bus Study Public Involvement

D. Service Design Guidelines

E. Title VI Environmental Justice Analysis

F. Regional Human Services - Public Transit Gap Analysis

G. Memorandum on Local SEAT Funding Contributions

APPENDIX A

Transit Market Analysis

SEAT BUS STUDY

TRANSIT MARKET ANALYSIS

December 2014

SCCOG SEAT CONNECTICUT DEPARTMENT OF TRANSPORTATION

NELSON NYGAARD ASG PLANNING

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1 INTRODUCTION

Southeast Area Transit (SEAT) serves the 10 member municipalities of Griswold, Lisbon, Norwich, Montville, East Lyme, Waterford, New London, Groton, Ledyard, and Stonington in southeastern Connecticut (see Figure 1). SEAT provides fixed route service throughout these communities via 15 routes as shown, plus complementary ADA paratransit service for those residents unable to use fixed route service. These SEAT member cities and towns are part of the Southeastern Connecticut Council of Governments (SCCOG), which also include the non-SEAT member municipalities of Windham, Lebanon, Franklin, Sprague, Colchester, Bozrah, Salem, Preston, and North Stonington. ***The purpose of this market analysis is to examine the underlying conditions in the SEAT market area as they relate to the demand for transit service and the types of services that best match the demand.***

A large number of factors impact the inherent demand for transit and actual use. These include:

- Community characteristics
- The physical environment
- How well transit service is designed
- Time and costs for alternative modes

This document focuses on community characteristics, and does so through the examination of a number of factors that are strong indicators of demand. These include:

- ***Population and employment densities*** are the strongest indicators of transit demand. Put simply, where larger numbers of people live and/or work in close proximity, transit demand is higher.
- ***Socioeconomic characteristics***, such as income, access to an automobile, minority status, disability status, and age, indicate where there is demand from populations that have a high propensity toward transit use.

It should be stressed that each of these factors provides one indication of transit demand, yet each must also be considered in the broader context of the surrounding physical and demographic environment. For example, nearly all transit riders are also pedestrians on at least one end of their trip, thus the suitability of the walking environment strongly impacts ridership. A common rule of thumb is that transit riders will walk one-quarter of a mile to access transit. However, in comfortable pedestrian environments, many transit riders will walk longer distances, while in uncomfortable environments many will not walk that far. In other words, the size of a transit market can be directly impacted by the nature of development in that area.

The availability and attractiveness of options for each transit trip also strongly influences overall transit demand. Transit service frequencies are closely related to market size. Bigger markets support more frequent service, while smaller markets can support only less frequent service. Slow circuitous routes that take people closer to their destinations may be preferred by some riders, such as many elderly and persons with disabilities, but are seen as inconvenient to others. Thus, no matter the inherent demand for transit, service must be designed appropriately to appeal to local markets, while also considering that external factors will impact demand.

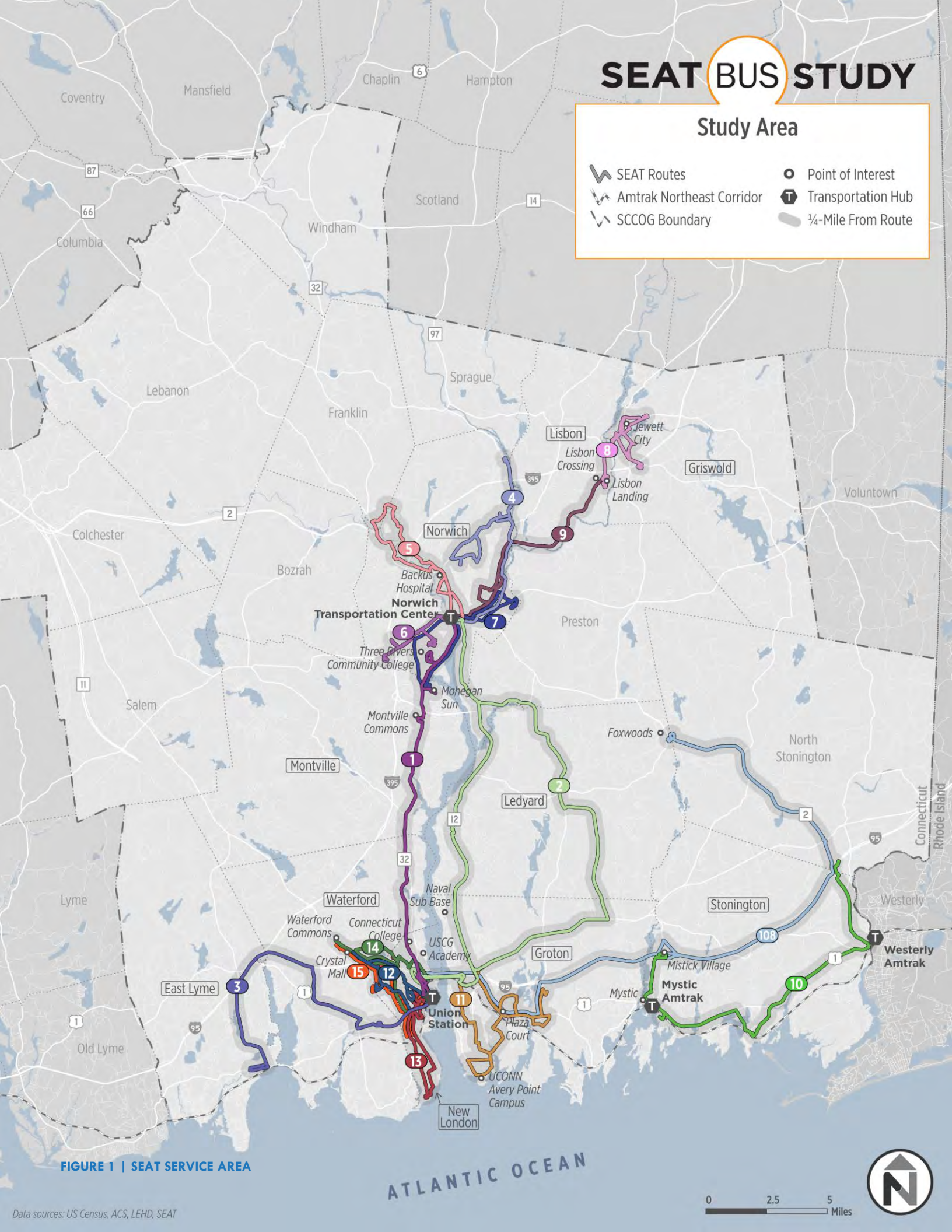


FIGURE 1 | SEAT SERVICE AREA

Data sources: US Census, ACS, LEHD, SEAT

2 POPULATION DISTRIBUTION

The distribution and density of population is among the most important factors influencing the viability of transit service because nearly all transit trips require walking to/from the bus on at least one end of the trip. Higher density communities have more people within walking distance of common corridors that might support transit. Together with employment density, population density will determine the success of transit more than any other factor.

In addition, population density also provides an indication of the types of riders that transit will serve. In general terms, there are two types of transit riders:

- **Discretionary riders** who have sufficient resources and the ability to operate private vehicles but choose to use transit for some or all trips. Discretionary riders may choose transit to avoid congestion, the high cost of long commutes, and/or high parking charges, among other reasons.
- **Transit-dependent riders** who use transit services because they don't have an automobile available for their trip or are unable to operate a private vehicle. Because they have one less choice for travel, they rely more on transit than discretionary riders. Transit-dependent riders are also more likely to use transit to get to appointments, shop, and visit friends/family.

The ample population in densely developed areas produces demand for frequent service that increases the attractiveness of transit for both rider types. However, in less densely developed areas, the overall demand is lower and, consequently, service levels tend to be lower. As a result, discretionary riders often comprise a smaller share of ridership in less developed areas.

Data from the 2010 U.S. Census has been mapped at the block level to illustrate the distribution of population throughout the SCCOG region (see Figure 2 at right).

- The most significant population cluster in the SCCOG area is New London, closely followed by clusters in Norwich, Groton, Griswold and Windham. These areas are well-served by the SEAT system, with the exception of Windham which is part of the Windham Region Transit District.
- In terms of overall community population, Norwich represents 14.7% of SCCOG's population, Groton 14.1%, and New London 9.9%.
- Moderate clusters of population are found in Waterford, East Lyme, Stonington and Colchester. Waterford is directly adjacent to New London and benefits from high levels of SEAT service in the area. Services are more limited in East Lyme and Stonington (part of a population cluster spanning the border with Westerly, RI). Colchester is not a SEAT member, but is served by one CTTransit express bus route to Hartford.
- Lisbon, Montville, and Ledyard are also SEAT member municipalities, but have significantly fewer residents and, therefore, correspondingly lower service levels. Remaining SCCOG communities have low density population and are not SEAT members.
- The population clusters of New London, Groton, and Waterford are more efficiently served with transit because they are geographically clustered, with limited travel distance between them. The opposite is true of more isolated population clusters in communities such as Norwich, Griswold, East Lyme, and Stonington.
- Overall, SEAT serves a majority of the population living in its ten member municipalities, with 64.1% of the population living within ¼ of a mile of a SEAT route.

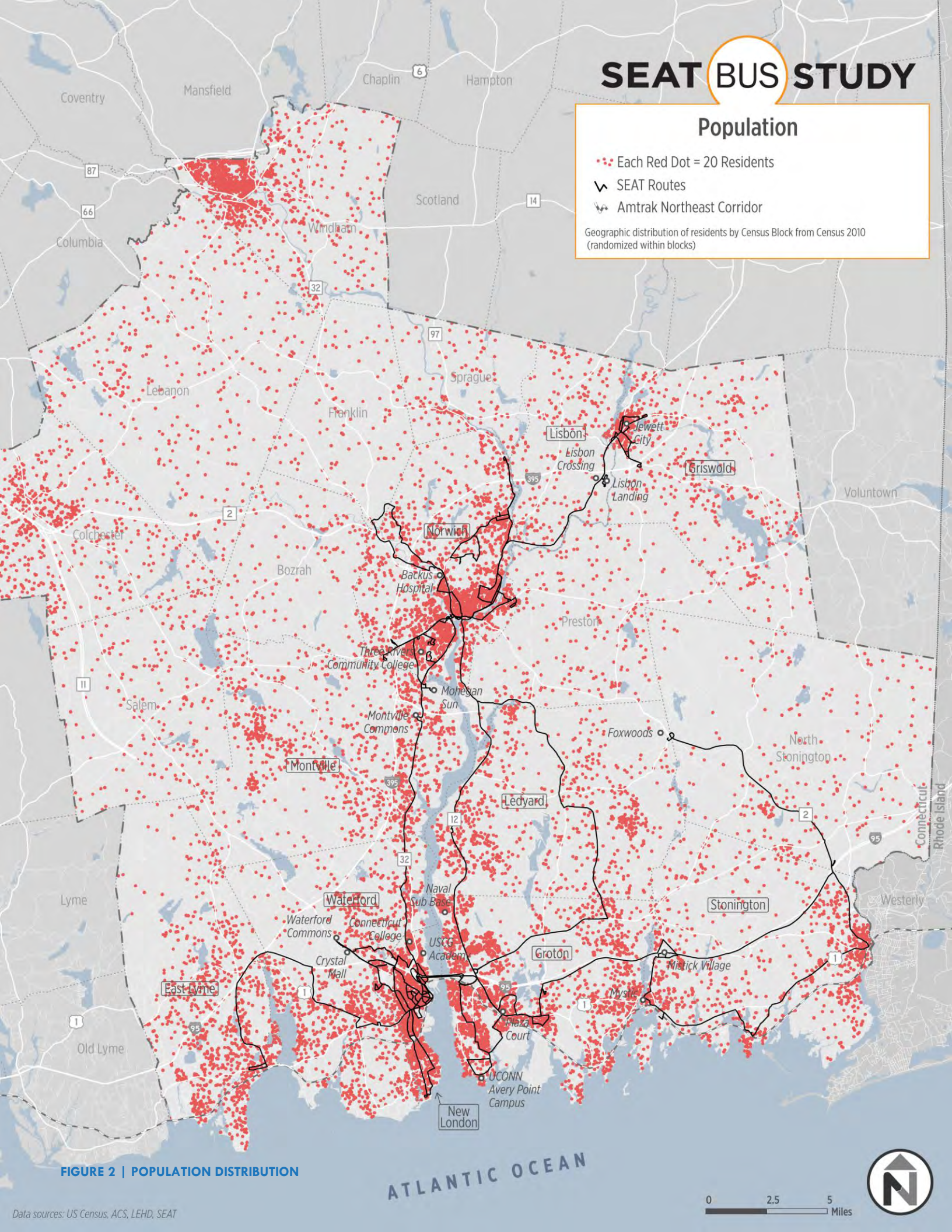


FIGURE 2 | POPULATION DISTRIBUTION

Data sources: US Census, ACS, LEHD, SEAT

3 POPULATION TRANSIT INDEX

Building on the population distribution data presented in Section 2, the study team used national evidence to determine the level of transit service supported by the various population densities throughout the market area. Evidence from a variety of academic studies and on-the-ground results from across the U.S. have been collected and aggregated to identify transit-supportive population densities as shown in Table 1. The table indicates minimum population densities required to support various levels of transit service.

Note that this index is a general measure to broadly indicate demand across a community and is not meant to predict precise demand at the block or block group level. For example, a geographically isolated Census block with high density would not in and of itself provide sufficient demand to effectively provide high level service; however, a significant cluster of similarly-dense blocks would indicate an area of potential demand.

TABLE 1 | TRANSIT-SUPPORTIVE POPULATION DENSITIES

TRANSIT SERVICE LEVEL	MINIMUM POPULATION/ACRE
Flex Bus	0.5
Community Circulator	2
Local Bus	
60-minute frequency	8–16
30-minute frequency	16–31
15-minute frequency	31–47
10-minute frequency	47–92
5-minute frequency	>92

Source: Nelson\Nygaard compiled from various national sources.

The population density of census blocks in the market area was indexed to the values in Table 1 and the results are shown in Figure 3 at right. As seen in the map, several findings are apparent:

- Much of the market area has very low population density and, therefore, has very low transit demand. This is the case for the whole of Lisbon and much of Ledyard.
- The communities of Montville, Stonington, East Lyme, and Waterford all have population centers, including their town centers, that are somewhat transit-supportive. These centers could likely support basic transit service, though the geographic distance of Stonington and East Lyme from the rest of the service area makes these communities more difficult to serve productively.
- New London, Waterford, Groton, and Norwich all display population densities in town centers that warrant 10-30 minute service frequencies, with New London, Norwich, and Groton having the highest transit service needs in terms of population density in the SEAT system.
- Overall, transit service appears relatively well-matched to demand. However, there are two non-member communities that have strong population densities that may indicate demand for service. These include the SCCOG communities of Windham, which is served by the Windham Region Transit District, and Colchester. Colchester has pockets of density that may be somewhat transit supportive but, as with Stonington and East Lyme, is challenged by its geographic distance from other population centers in the SEAT district.

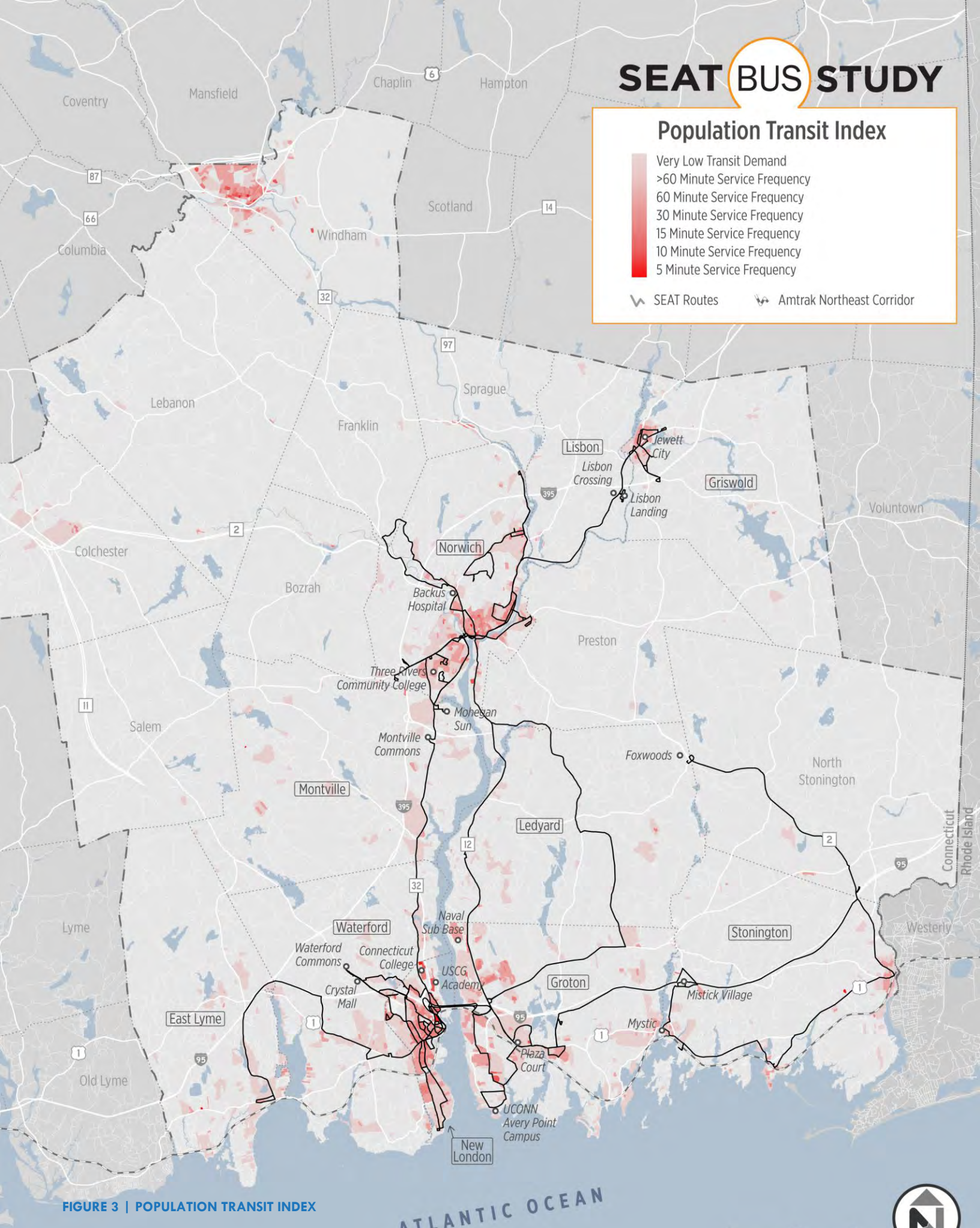


FIGURE 3 | POPULATION TRANSIT INDEX

Data sources: US Census, ACS, LEHD, SEAT

4 EMPLOYMENT DISTRIBUTION

Employment is especially important in travel markets because traveling to and from work often accounts for the singular most frequent type of trip. Therefore, understanding the distribution and density of employment is critical to transit service design. Transit that serves areas of high employment density provides key connections to job opportunities.

Data from the 2010 U.S. Census LEHD Origin-Destination Employment Statistics (LODES) was mapped to display employment density at the block level as shown in Figure 4. Several findings are apparent:

- Jobs are generally clustered in the central and southern portions of the SCCOG area, and within the SEAT service area. Additional pockets appear in Windham and Colchester.
- By municipality, Groton has the most jobs with 25,889, many of which work at the Naval Submarine Base, General Dynamics - Electric Boat, and Pfizer. Groton is followed closely by Norwich with 16,766, Montville with 14,527, New London with 14,486, and Waterford with 12,995. Major employers in these communities include the William W Backus Hospital in Norwich, Mohegan Sun Casino in Montville, US Coast Guard Academy in New London, and Waterford Commons-Crystal Mall shopping centers in Waterford.
- East Lyme, Ledyard and Stonington have moderate job clusters in their community centers. Ledyard has a large number of jobs at Foxwoods Resort Casino.
- Other communities have very few jobs outside small concentrations, such as Griswold and Lisbon.
- Similar to population density, the job clusters in Groton, New London, and Waterford can be more efficiently served by transit because they are geographically clustered. The Montville, Griswold, Ledyard, and Stonington job clusters, on the other hand, are more difficult to serve effectively as part of the SEAT network because of their geographic isolation. Long trips to and from the Norwich and New London areas are required to connect these markets with the rest of the network.
- Overall, SEAT serves a large majority of jobs in communities that are currently served by the system, with 79.0% of employees working within ¼ of a mile of a SEAT route.

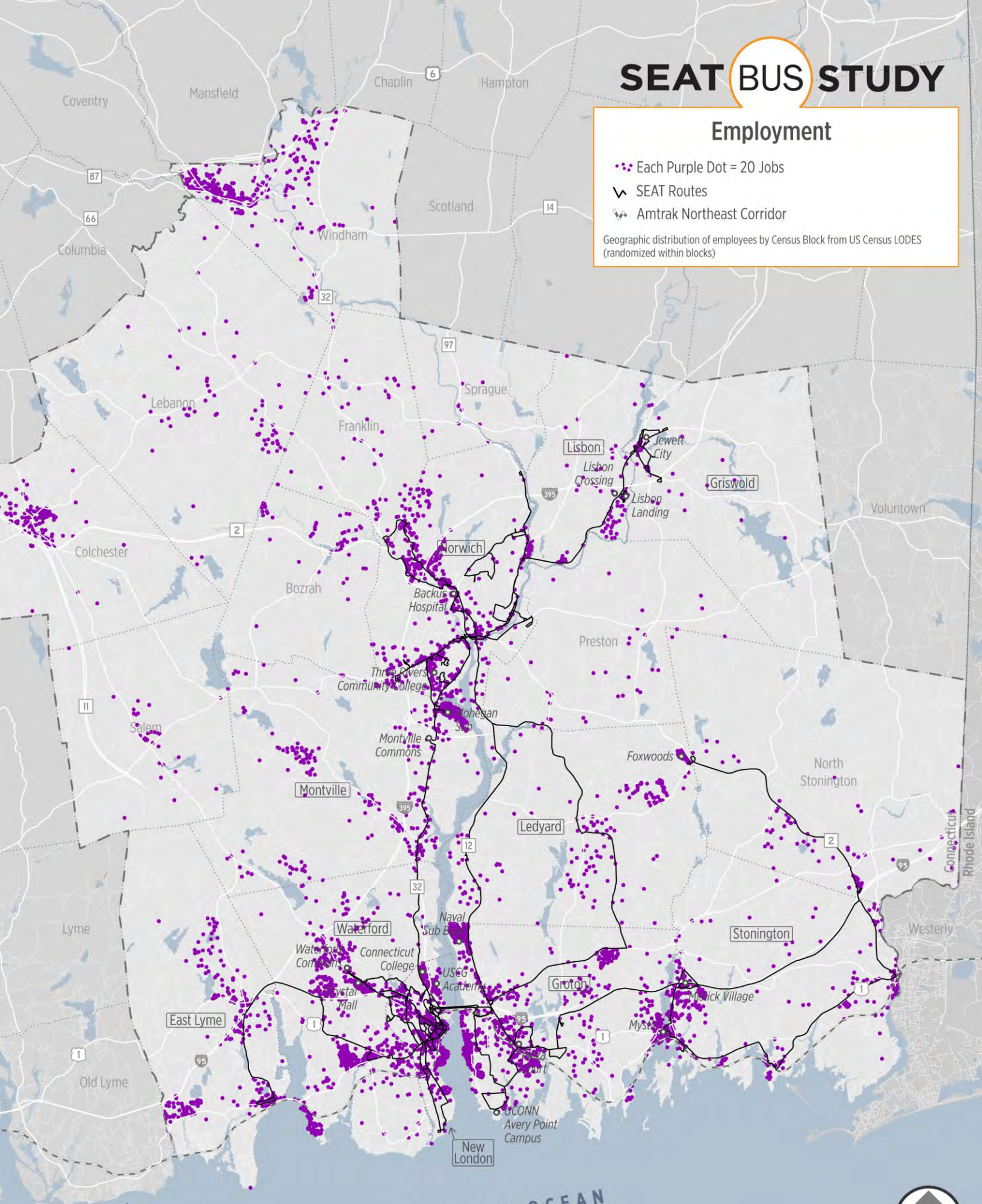


FIGURE 4 | EMPLOYMENT DISTRIBUTION

Data sources: US Census, ACS, LEHD, SEAT

5 EMPLOYMENT TRANSIT INDEX

Similar to the population transit index presented in Section 3, the study team used national evidence to determine the level of transit service supported by the various employment densities throughout the market area. Evidence from a variety of academic studies and on-the-ground results from across the nation have been collected and aggregated to identify transit-supportive employment densities as shown in Table 3 below. The table indicates the minimum employment densities required to support various levels of transit service.

TABLE 2 | TRANSIT-SUPPORTIVE EMPLOYMENT DENSITIES

TRANSIT SERVICE LEVEL	MINIMUM EMPLOYMENT/ACRE
Flex Bus	0.5
Community Circulator	2
Local Bus	
60-minute frequency	4–8
30-minute frequency	8–16
15-minute frequency	16–24
10-minute frequency	24–48
5-minute frequency	>48

Source: Nelson\Nygaard compiled from various national sources.

Similar to the population transit index, the employment density of census blocks in the market area was indexed to the values in Table 3 above and the results are shown in Figure 5 at right. Again, this index is meant to broadly indicate demand across the market. Several findings are apparent:

- Transit-supportive employment densities are heavily clustered in just a few specific areas. Several census blocks in New London, Groton, and Norwich have sufficient employment to support significant transit service. These areas have the highest level of transit service in the market area today, with a number of options for travel throughout the network.
- Foxwoods Resort Casino in Ledyard, Mohegan Sun Casino in Montville, the Naval Submarine Base in Groton, and downtown Mystic all have employment levels that would theoretically support 5 minute service frequencies. However they are relatively isolated, with Foxwoods and downtown Mystic in particular involving long distances that affect the overall productivity of the system.
- Waterford and Stonington have moderate employment density to support transit, though to a much lesser degree than New London. These town centers could support some transit service, though they are geographically dispersed (particularly Stonington) and difficult to link efficiently.
- Much of the SEAT market area does not have sufficient employment density to support fixed route transit service. This includes nearly the entire communities of Griswold, Lisbon, and East Lyme. However, Griswold and East Lyme have transit supportive population densities.
- As with the population index, the SCCOG communities of Windham and Colchester have employment densities that are transit supportive but are currently not SEAT members.

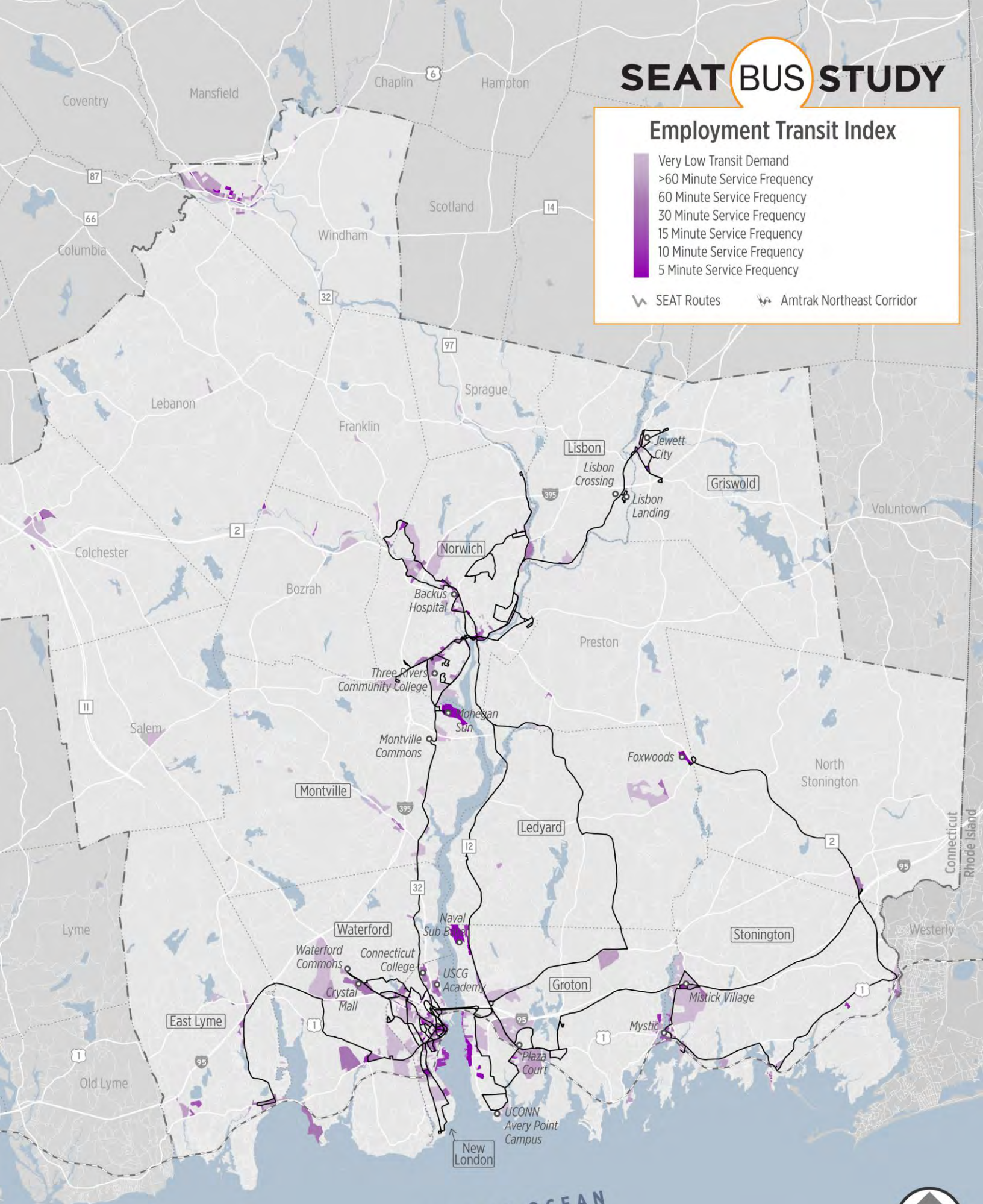


FIGURE 5 | EMPLOYMENT TRANSIT INDEX

Data sources: US Census, ACS, LEHD, SEAT

6 LOW INCOME INDIVIDUALS

More than any other demographic group, low-income status is the strongest indicator of a higher-than-average propensity to use transit. This is primarily because as income falls, the cost of owning and using a private vehicle becomes more burdensome, which makes transit a more attractive option. For this reason, it is important to understand the geographic distribution of low income individuals in the travel market.

Poverty status data the U.S. 2010 Census was used to define and identify low income individuals. Because disposable income is largely a factor of household size and household income, the U.S. Census considers household income and the number of members in the household in classifying a household's poverty status. The distribution of individuals with low incomes (those living in a household considered in poverty by the Census), after multiplying households in poverty by the average household size in each county in which the communities lie, is shown in Figure 6 at right.

The data is from the U.S. Census' American Community Survey 5-Year Estimates 2006-2010 at the census block group unit of analysis. A number of findings are apparent:

- The largest clusters of low-income individuals are in Norwich and New London. These areas are currently served by numerous SEAT routes, which provide good connectivity within New London and Norwich, as well as throughout the SEAT network.
- Additional significant clusters of low-income individuals exist in Groton and the Griswold borough of Jewett City, which are also directly served by SEAT.
- Many towns have very few low income individuals, such as Lisbon, Montville, Ledyard, and East Lyme. While this is most likely correlated to these towns having lower overall populations, it also indicates areas where demand for transit is likely to be lower.
- There are moderate to significant clusters of low income individuals living in towns outside of the current SEAT service area, such as Windham and Westerly, Rhode Island. While these communities have their own local service providers, the lack of SEAT transit service to these communities limits travel options throughout Southeast Connecticut for low income individuals.
- A very large majority of the area's low income residents are currently served by the SEAT system. Of the 18,514 low income individuals in SEAT communities, 91.5% live within ¼ of a mile of a SEAT route.

Note that dots are placed randomly within geographic units (blocks or block groups) in all of the density maps in Figures 6 through 10; therefore the placement of dots should be interpreted as a general indication of the clustering of residents in each group.

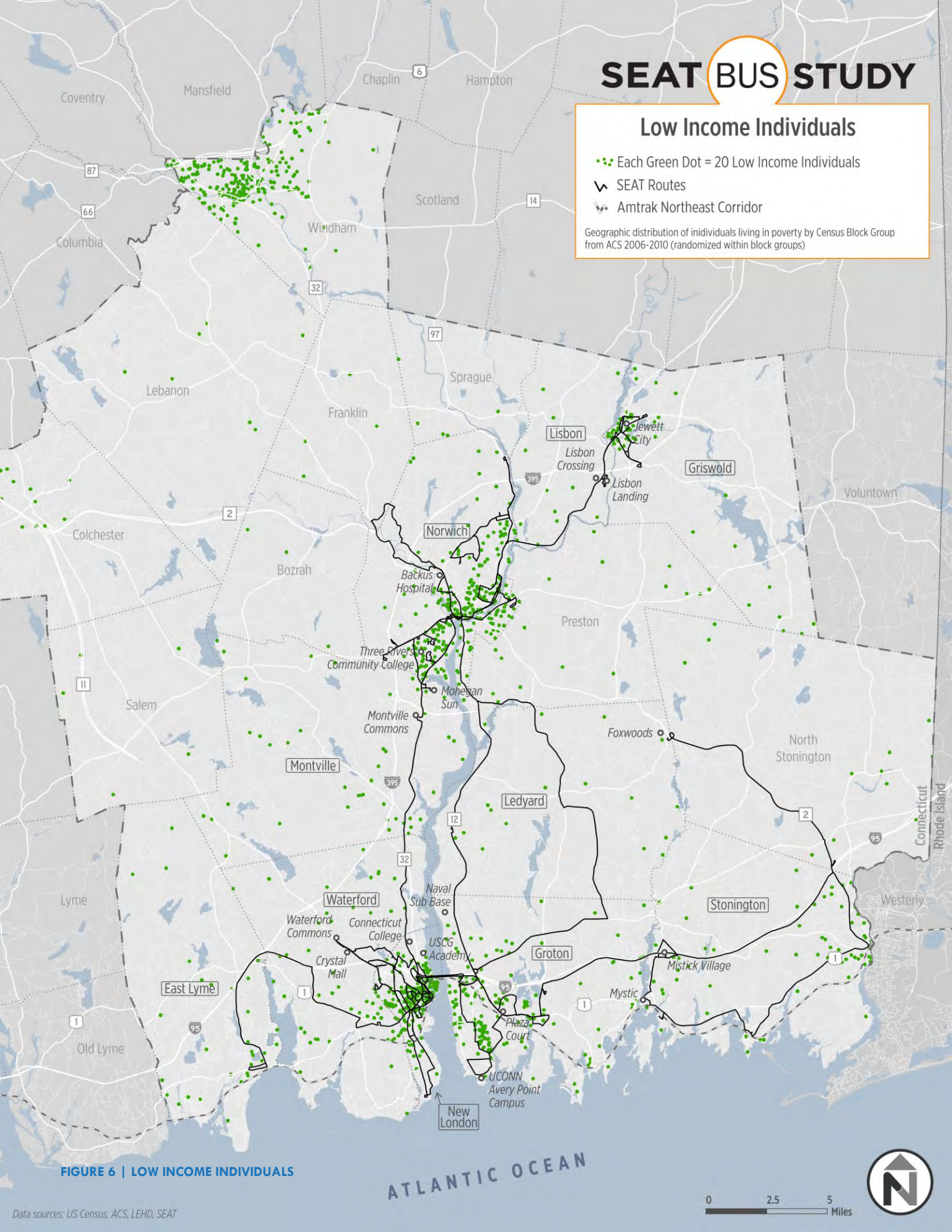


FIGURE 6 | LOW INCOME INDIVIDUALS

Data sources: US Census, ACS, LEHD, SEAT

7 INDIVIDUALS WITHOUT ACCESS TO A VEHICLE

For self-evident reasons, individuals without access to a vehicle represent a particularly strong market for transit. In many cases, individuals do not have access to an automobile, while in others, individuals do not own a car because they choose to use transit as their primary mode of transportation. Identifying individuals without access to a vehicle helps in identifying areas that are likely to have a significant number of transit-dependent riders.

Data from the U.S. Census' American Community Survey 5-Year Estimates 2006-2010 was used to identify individuals who do not have regular access to a vehicle. The geographic unit of analysis for this data is the census block group.

A number of findings are apparent in Figure 7:

- Individuals without access to a vehicle are clustered in the densely developed and populated communities of Norwich, New London, Griswold, and Groton, where transit service is most readily available. This is expected, as these highly transit-dependent individuals typically choose to locate in areas where they perceive transit service to be reliably available over the long-term.
- Conversely, less densely developed areas have significantly fewer individuals without access to a vehicle. Without access to consistent and stable transit service in these areas, having access to a vehicle becomes more of a necessity. These towns include Lisbon, Ledyard, Montville, Waterford, East Lyme, and Stonington.
- The SCCOG communities of Colchester and particularly Windham, as well as Westerly, Rhode Island, have significant populations without access to a vehicle. While these communities each have some level of local (non-SEAT) transit service, these clusters of highly transit-dependent individuals may have latent demand for additional transit service connections within the region.
- Individuals without access to a vehicle are generally well served within the current SEAT system service area. With 15,530 individuals with no vehicle access in SEAT member municipalities, 94.3% live within ¼ of a mile of SEAT service.

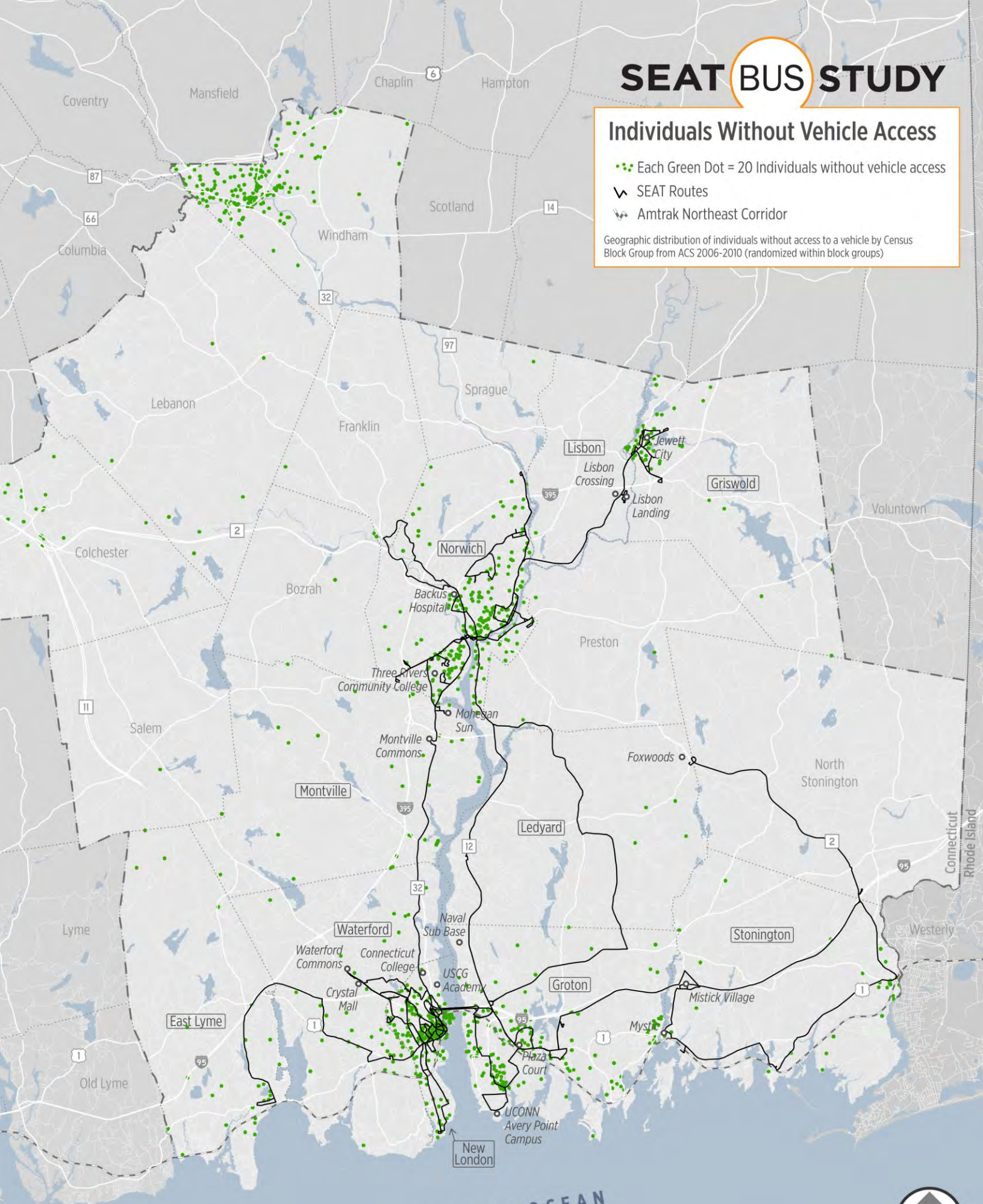


FIGURE 7 | INDIVIDUALS WITHOUT ACCESS TO A VEHICLE

Data sources: US Census, ACS, LEHD, SEAT

8 OLDER ADULTS

Older adults (those 65 years and older) are more likely to use transit than the general population because they have chosen to stop driving or can no longer drive. Throughout the country, this is a key market for transit, in part because it is increasing so dramatically. In 2000, 35 million Americans were age 65 and over, or 12.4% of the total population. By 2010, that number had grown to 40 million, or 13.0% of the total population. This trend is expected to continue and accelerate as the Census Bureau projects this group will jump to 70 million people by 2030 and represent 20% of the total population. Understanding the distribution of older adults is therefore important in identifying areas of more transit-dependent riders.

Data from the U.S. 2010 Census was used to map individuals aged 65+ by census block. Figure 8 at right shows the geographic distribution of these older adults throughout the SCCOG area. A number of findings are apparent:

- The map illustrates the dispersion of older adults and their lack of clustering when compared to the other socioeconomic groups. This is evident in communities such as East Lyme, which has a higher proportion of older adults to total population than more traditional, dense communities such as Groton.
- While the distribution of older adults roughly tracks with the population in general, they are more likely to live in suburban environments and outlying communities, and less likely to live in city centers. This makes this group more difficult to serve with fixed route service.
- Since older adults tend to live outside of town centers, they are less served by existing transit and/or have fewer service options. Waterford, Stonington, and Montville have a significant number of older adults who have limited transit options.
- Due to the geographic dispersion of older adults throughout the market area, a fewer proportion of the older adults in SEAT member municipalities are within ¼-mile of transit service. Currently of the 31,500 adults aged 65+ within SEAT member municipalities, 62.1% live within ¼-mile of transit service. Due to mobility issues often related to an aging population, it is not reasonable to expect older adults to walk beyond ¼-mile for SEAT service. Therefore, older adults living in large portions of East Lyme and Montville lack access to the SEAT system.

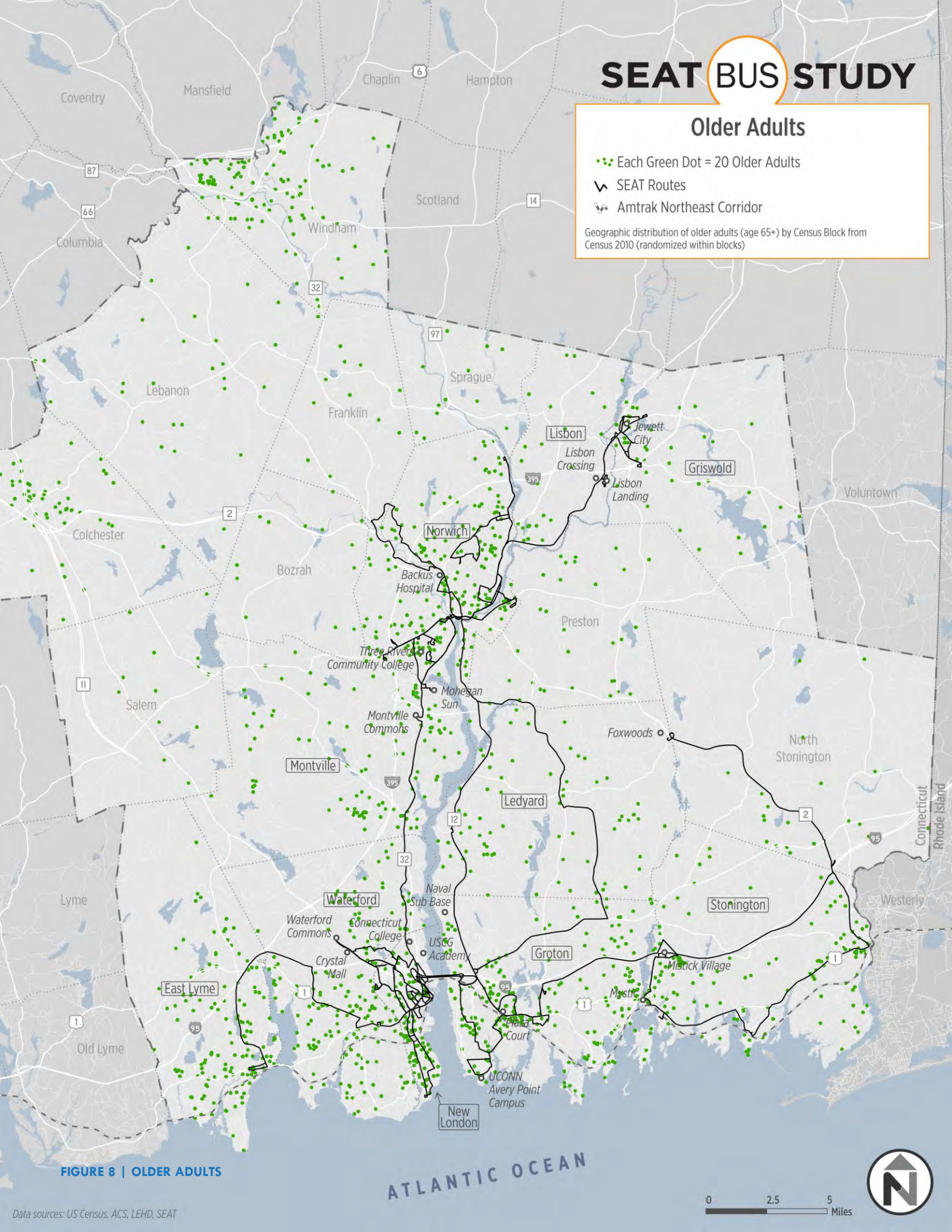


FIGURE 8 | OLDER ADULTS

Data sources: US Census, ACS, LEHD, SEAT

9 MINORITY INDIVIDUALS

National research shows that minority populations use transit to a much higher extent than non-minority populations. This is largely because minorities, on average, have lower incomes than non-minorities and there is a large amount of overlap between minority populations and low income households. Still, the presence of high numbers of minority residents is a strong indicator of transit demand. The provision of effective transit service to minority populations is also particularly important to the Federal Transit Administration, and a requirement under Title VI of the Civil Rights Act of 1964.

Data from the U.S. 2010 Census was used to map minority individuals by census block. A "minority" individual is an individual that identifies as any non-white race. Figure 9 at right shows the geographic distribution of these minorities throughout the SCCOG area. A number of findings are apparent:

- Overall, the distribution of minorities is very heavily concentrated in the communities of New London, Norwich, and Groton, which are all currently served by multiple SEAT routes providing good connectivity throughout the SEAT network. These concentrations typically occur in or near the city centers of each of these three communities.
- Smaller clusters of minorities exist in East Lyme, Montville, Griswold, and Ledyard. The limited transit service in these areas is largely oriented toward through travel to major destinations such as Norwich, New London, or area casinos, with limited direct travel options to other destinations throughout the service area.
- As with most of the other demographic indicators, Windham has a significant minority population but served by its own local transit service.
- A majority of minorities live near SEAT service. Of the 45,873 minorities living in SEAT member municipalities, 78.2% live within ¼-mile walking distance of service. A large portion of minorities without direct transit service are found in East Lyme and Montville.

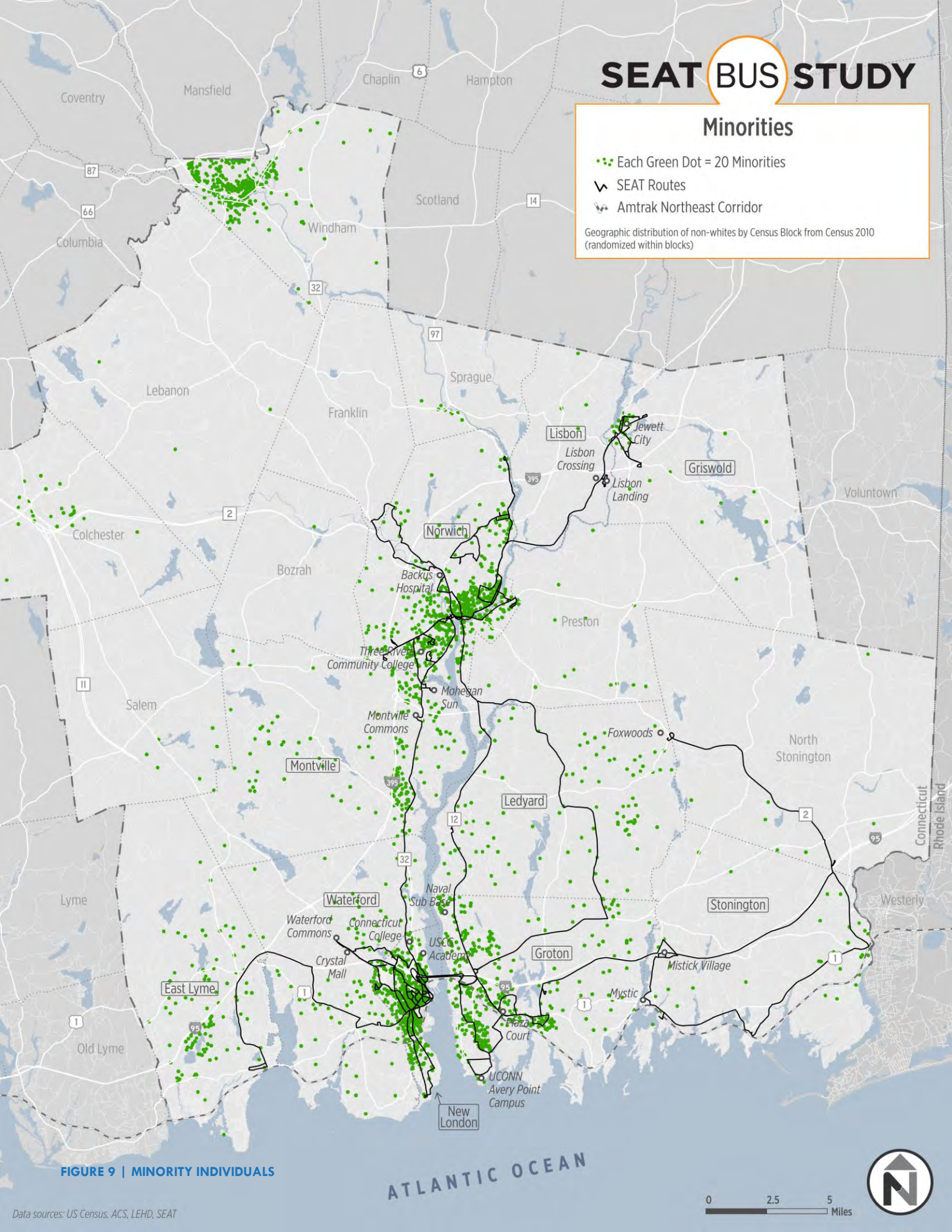


FIGURE 9 | MINORITY INDIVIDUALS

Data sources: US Census, ACS, LEHD, SEAT

10 INDIVIDUALS WITH A DISABILITY

Persons with disabilities are more likely to utilize transit than the general population, often due to their inability to operate a vehicle or otherwise have independent mobility options. According to the American Community Survey 5-Year Estimates from 2008-2012, 14.7% of adults in the U.S. have a disability. The share of adults 65 years or older is even higher, at 36.8%, which underscores the significance of this group on transit service demand.

Data from the U.S. Census American Community Survey 5-Year Estimates 2008-2012 was used to map individuals who claim a disability. The geographic unit of analysis for this data is the census block group.

Additionally, individuals with a disability often cannot use fixed route service and are therefore eligible for ADA complementary paratransit service. For this reason, the distribution of individuals with a disability is important when considering the coverage of paratransit service, which is provided to individuals residing within ¾-mile of SEAT fixed route service. Figure 10 illustrates the distribution of individuals with a disability and also shows a ¾-mile buffer drawn around SEAT routes to indicate the coverage area of ADA paratransit service.

A number of findings are apparent:

- Individuals with a disability are clustered in the densely developed and populated communities of Norwich, New London, and Groton, where fixed route transit service and ADA paratransit service is most readily available. This is expected, as these highly transit-dependent individuals typically choose to locate in areas where they perceive transit service to be reliably available over the long-term.
- Although Montville and East Lyme both have moderate numbers of individuals with a disability overall, the development pattern in these communities means that clustering is extremely rare or nonexistent.
- Conversely, communities that lack the multiple transportation options that several transit lines provide tend to have fewer individuals with a disability. These towns include Lisbon and Stonington.
- SEAT fixed route and ADA paratransit service currently serves a large majority of individuals who have a disability. As with older adults, mobility concerns greatly limit the distance at which individuals with disabilities may travel to reach SEAT service. With a disabled population of 27,002 in SEAT member municipalities, 83.2% live within ¼-mile of at least one SEAT route.

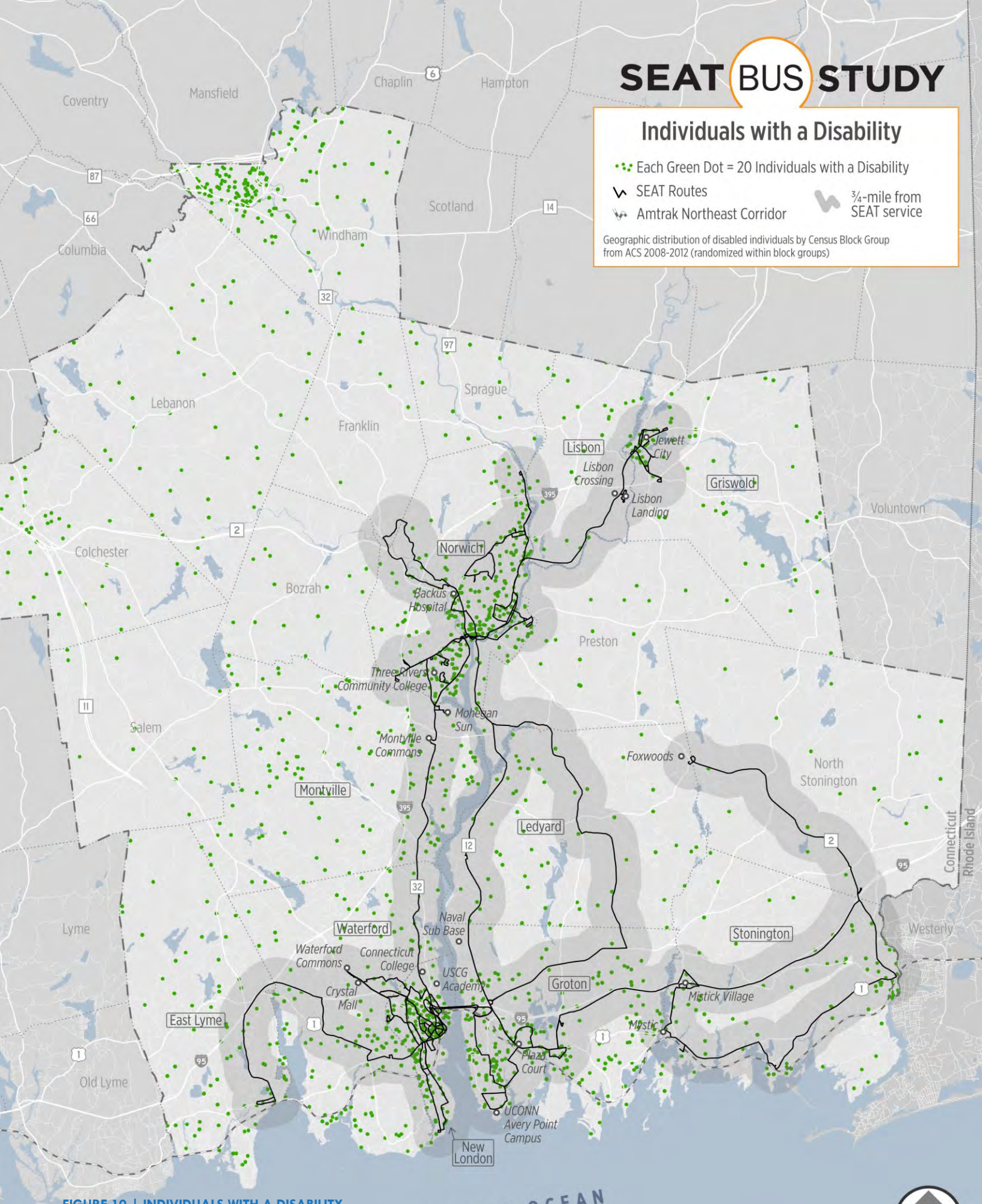


FIGURE 10 | INDIVIDUALS WITH A DISABILITY

Data sources: US Census, ACS, LEHD, SEAT

11 COMPOSITE TRANSIT INDEX

This section presents a measure of overall transit demand by combining population and employment density to produce a composite transit index. This index indicates the level of transit service supported by population and/or employment in each census block. This baseline index is effective at explaining the overwhelming majority of the demand for transit, and the socioeconomic factors illustrate an additional but smaller share of the demand for transit.

Note that this data provides an indication of transit demand, and not a specific determination. As described at the beginning of this document, ridership on individual routes and the effectiveness of individual routes can vary significantly depending on a number of factors, including the physical environment, how well service is designed, and the time and costs for competing alternatives. For example:

- Even if the propensity of an area's residents to use transit is very high, ridership will be high only if available service conveniently takes them where they want to go, and low if it doesn't.
- If an area can theoretically support the operation of service every 10 minutes, but multiple routes operate in close proximity, the demand for each individual route will be proportionally lower.
- Slower, more circuitous routes will attract fewer discretionary riders than faster, more direct routes.

Even in consideration of these other factors, this index still provides a very strong indication of the relative demand for transit throughout the market area, and identifies areas where demand is highest and transit can be provided most effectively. A number of findings are apparent in Figure 11:

- New London, Norwich, and Groton are by far the most transit-supportive areas in the SEAT district. Nearly all of New London has sufficient population and employment density to support a very high level of transit service. Much of central and southern Norwich, as well as western Groton, can also support significant transit service.
- The Village of Mystic between Groton and Stonington and the borough of Jewett City in Griswold have moderate transit demand. However, their geographic isolation makes them difficult to serve effectively. Linking these towns to the SEAT network requires routes to travel through extensive areas with very low demand for transit. Even as these towns continue to develop and densify, their geographic isolation will make them difficult to serve effectively.
- Similarly, there are many isolated points of interest that have high demand for transit. These include Foxwoods Resort Casino, Mohegan Sun Casino, and the Naval Submarine Base, largely due to high concentrations of employees.
- Windham and Westerly RI, each served by its own local transit service, also have high transit demand. While not currently SEAT members, there may be demand for improved regional transit connections, perhaps through coordination with these other transit agencies. Colchester also has a strong transit supportive town center. Of these communities, Westerly, Rhode Island is the closest to the current SEAT network, potentially allowing for more direct service without a significant loss in service productivity.

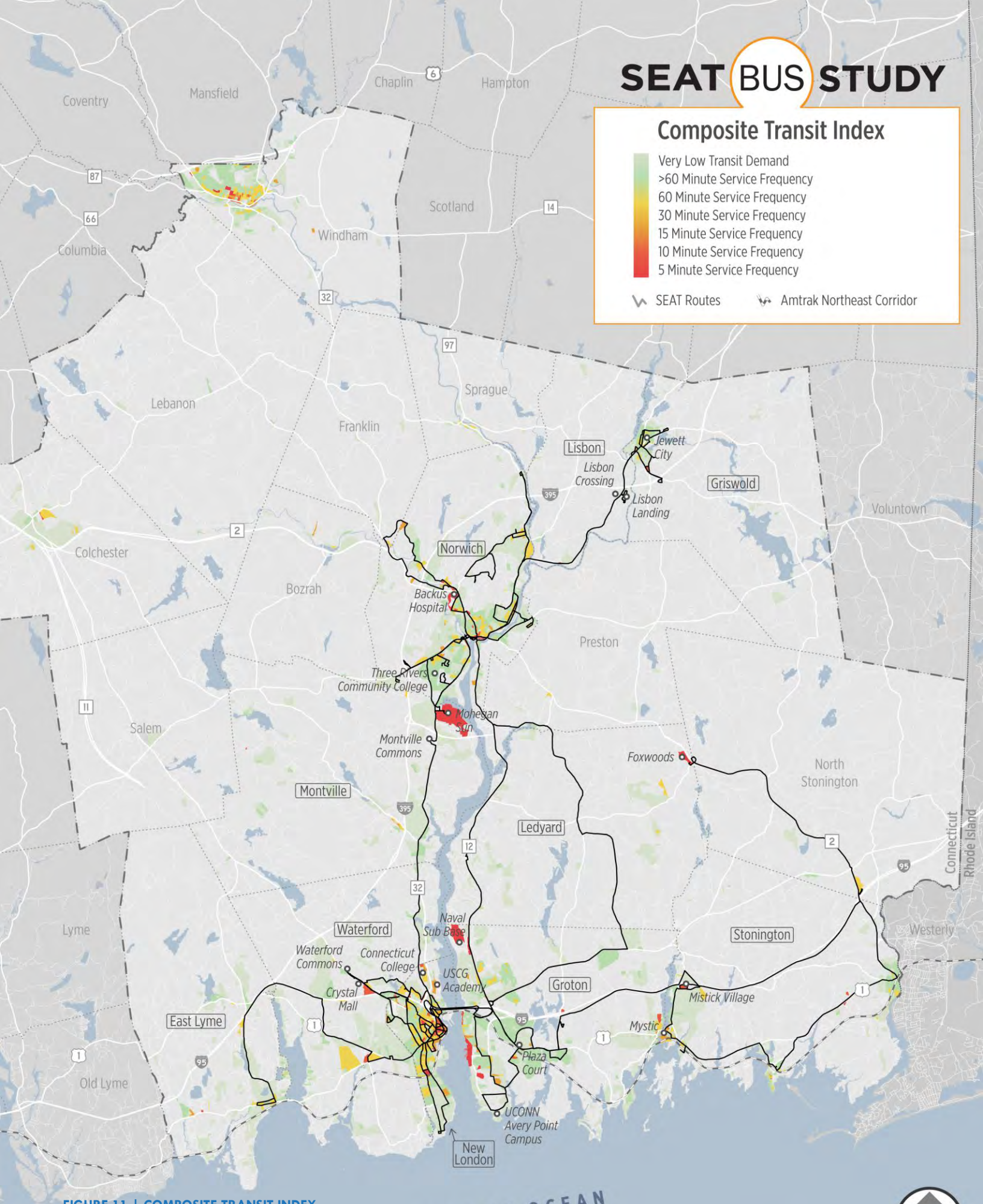


FIGURE 11 | COMPOSITE TRANSIT INDEX

Data sources: US Census, ACS, LEHD, SEAT

12 SUMMARY OF FINDINGS

This market analysis describes the market for transit service within SCCOG communities, particularly within SEAT member municipalities. Overall, the findings indicate the SCCOG area is characterized by generally low development density aside from a few clusters of dense development in Norwich, New London, and Groton, as well as Windham which has its own local transit district. Low density areas are unlikely to generate much demand for transit service, so SEAT's best strategy is to serve areas of higher density and more demand. However, while the New London and Groton clusters of density are in close proximity, the Norwich cluster of density is geographically isolated, presenting a challenge for SEAT productivity as interim areas are unlikely to generate sufficient demand for productive service. Also:

- Population and employment are overwhelmingly located in the New London and Norwich areas, as well as the City of Groton. These areas are the core of the SEAT service area, and can support the most significant and productive levels of transit service due to the clustering of jobs and population in close proximity.
- Much of the SCCOG area is transit-unsupportive. Many outlying communities have a rural character and lack sufficient population and employment density to support fixed route transit service. These include Bozrah, Franklin, Lebanon, Lisbon, North Stonington, Preston, Salem and Sprague.
- Other SCCOG communities have sufficient demand for some type of limited service and most of these fall within the SEAT service area today: East Lyme, Griswold, Groton, Montville, Stonington and Waterford. For these, alternative service strategies such as flex service or limited stop express service may be more appropriate than fixed route service. Colchester has sufficient demand for limited service, but falls outside the SEAT service area. Ledyard has more limited demand, yet falls within the SEAT service area.
- Another key challenge is the further geographic isolation of several member municipalities, such as Griswold and Stonington. While these municipalities may be able to support moderate levels of transit service on their own, they are difficult to effectively integrate into the SEAT system as they are separated from the core market by areas of very low transit demand. The current system connects these isolated communities with limited service to New London or Norwich.
- Most large job sites such as the two casinos, General Dynamics - Electric Boat, and Pfizer are served by fixed route transit service. A few important job sites within the service area are not directly served, such as the Naval Submarine Base (which is served indirectly on Route 12).
- Transit-dependent groups of low income individuals, disabled individuals, individuals without access to a vehicle, and minorities generally cluster in areas of higher population density. Therefore, providing effective service to areas with higher population density also significantly benefits these groups.
- The transit-dependent group of older adults does not exhibit the same level of clustering and they are more dispersed throughout the area, making these individuals more difficult to serve transit.
- The non-member community of Windham has their own local transit service provider, and Colchester is served by a CTTransit express route connecting to Hartford. The demographics of these communities suggest there may be demand for improved connectivity throughout the region. However, the geographic isolation of these communities make providing productive fixed service difficult, so alternative forms of service may be more appropriate.

APPENDIX B

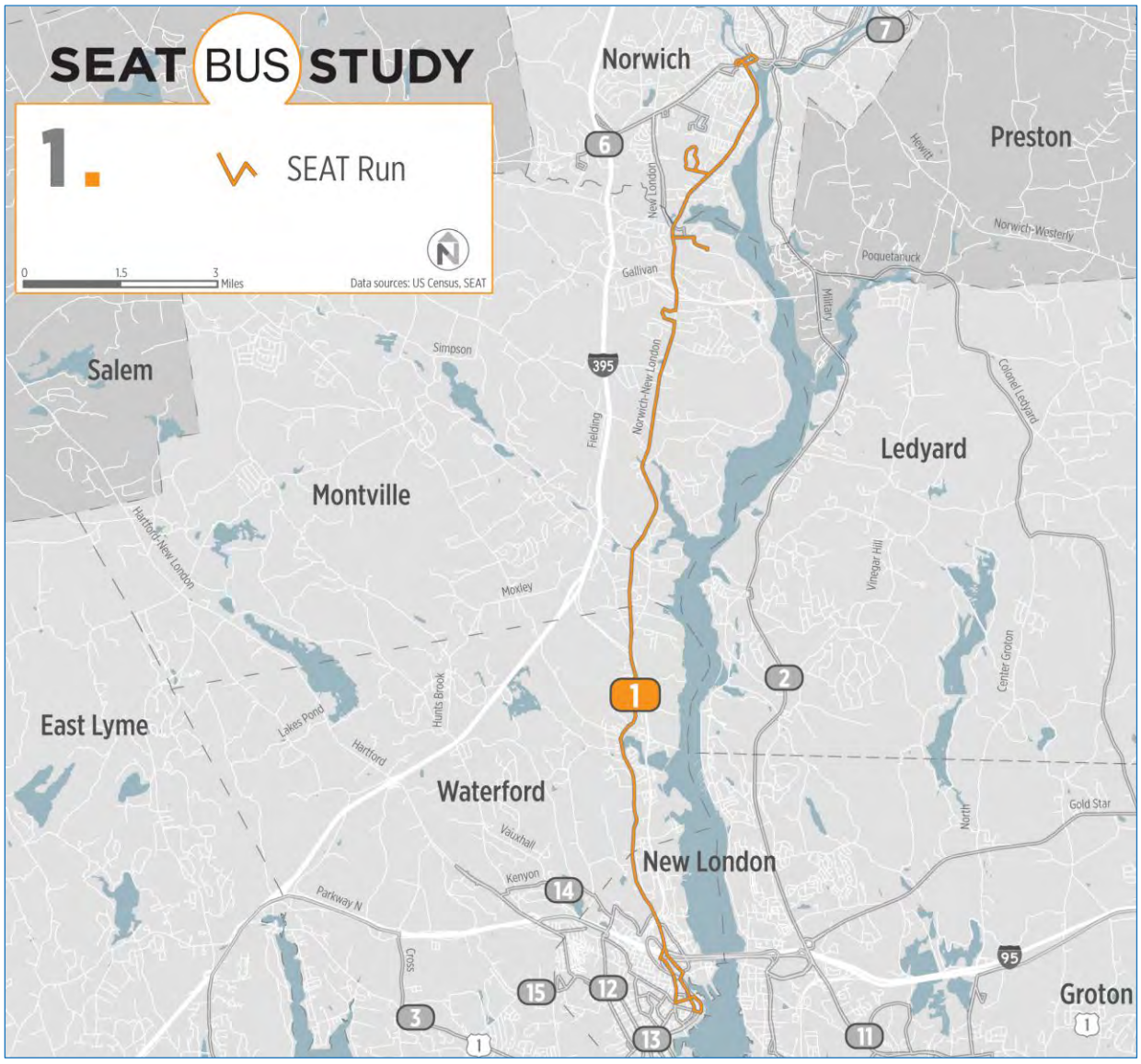
SEAT Run Evaluations

SERVICE EVALUATION

RUN 1/101 (NORWICH / MOHEGAN SUN / NEW LONDON)

Service Design. Run 1 is an important regional service that operates between New London Union Station and Norwich Transportation Center via Route 32 (Mohegan Avenue and Norwich–New London Turnpike) and West Thames Street. The run also deviates to serve Montville Commons and Mohegan Sun Casino. Additionally, supplemental trips added during the peak periods and after 7:00 PM are operated as Run 101 and follow the same alignment as Run 1.

FIGURE 1 – RUN MAP



Service Schedule. Runs 1 and 101 operate from 6:00 AM to 11:00 PM on weekdays and Saturdays, and from 7:00 AM to 2:00 PM on Sundays. Service is every hour during the morning peak with the supplemental trips operated as Run 101, and every two hours for the rest of the day as Run 1. Service between 7:00 PM and 11:00 PM is also operated as Run 101 Monday through Saturday.

FIGURE 2 - SCHEDULE STATISTICS

Service Day	Span of Service	Frequency (min) Peak / Off-Peak	Daily Trips
Weekday	6:00 AM — 11:00 PM	60* / 120	20
Saturday	6:00 AM — 11:00 PM	60* / 120	20
Sunday	7:00 AM — 2:00 PM	60	7

* 60-minute peak service due to supplemental 101 trips. Source: SEAT Run Schedules

Interaction with System. Runs 1 and 101 provide connections to most runs in the system at the New London Union Station and the Norwich Transportation Center. Generally, transfers are timed at these transit centers and occur on the hour. Outside of these major transfer points, Runs 1 and 101 interact with the following lines:

- Between Norwich Transportation Center and Mohegan Sun Casino, Run 7 southbound provides parallel service on West Thames Street.
- At William Street and Crystal Avenue, southwest of the United States Coast Guard Academy, connections can be made to Run 14 northbound for service to New London Mall. Due to scheduling, however, making this on-street connection would provide no time savings over connecting in downtown New London.
- The Three Rivers Community College Express parallels Run 1/101 for a significant portion of the run, providing parallel service when operating. In the morning, there is overlap on Mohegan Avenue south of Interstate I-395, where the Three Rivers Community College Express operates without stopping via the interstate highway. In the afternoon, the Three Rivers Community College Express overlaps on most of the Run 101 except near Connecticut College, where the former uses Old Colony Road instead of Mohegan Avenue. In addition, the Three Rivers Community College Express uses West Main Street and New London Turnpike in the southbound direction (instead of West Main Street on Run 1/101).

Ridership by Service Day. As a key connector between Norwich and New London, the combined Run 1 and 101 has the second highest weekday ridership and the highest ridership per trip in the system (See Figures 4 and 5). Ridership on weekdays averages 477 per day, 342 on Saturdays, and 63 on Sundays (see Figure 3). While weekday and Saturday ridership per trip (23.9 and 17.1, respectively) are nearly twice the SEAT average, Sunday service carries fewer riders per trip than the average, carrying just 4.5 riders per trip.

FIGURE 3 - RIDERSHIP STATISTICS

Service Day	Daily Ridership	Ridership per Trip	
	Run 1	Run 1	System Avg
Weekday	477	23.9	13.0
Saturday	342	17.1	9.5
Sunday	63	4.5	5.8

Source: SEAT Ridecheck 2014

FIGURE 4 - AVERAGE WEEKDAY RIDERSHIP

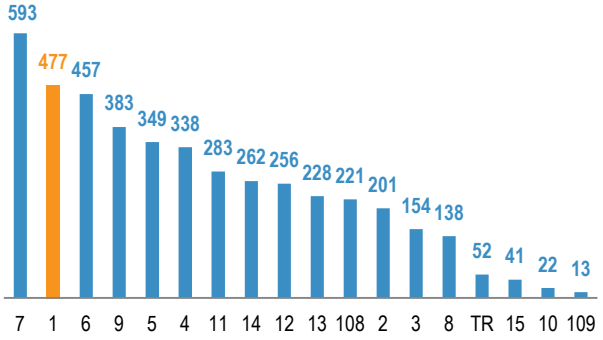
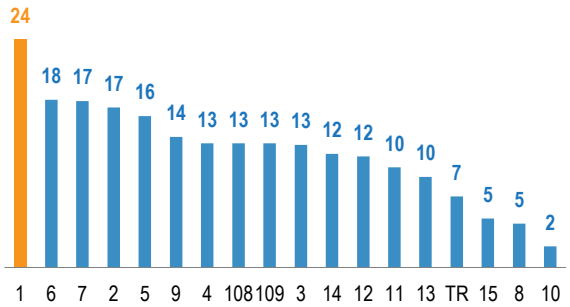


FIGURE 5 - AVERAGE WEEKDAY RIDERSHIP PER TRIP



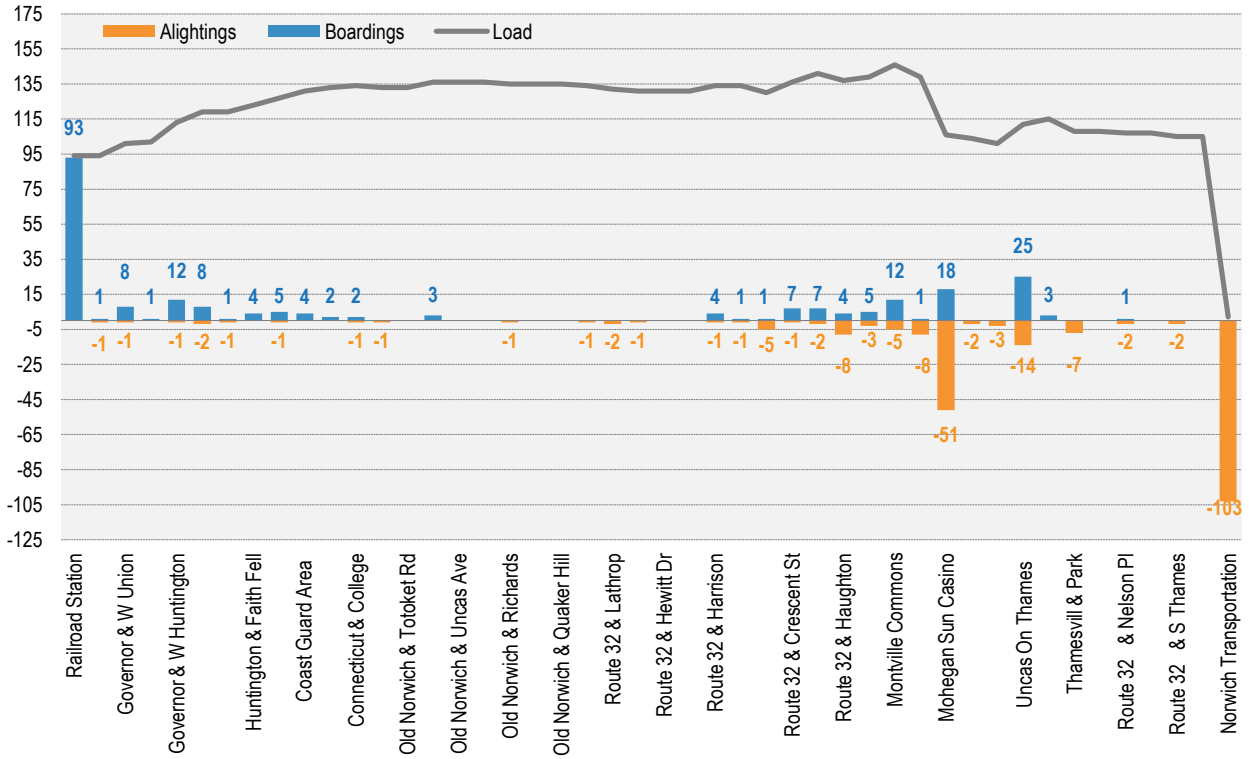
Source: SEAT Ridecheck 2014

Ridership by Stop. Run 1/101 ridership activity is very high at the endpoints, New London Union Station and Norwich Transportation Center (see Figures 6 through 9). In addition to being in the heart of two of the most important downtowns in the system, these are also two important anchors that provide transfer opportunities to most other runs in the SEAT system. Outside of these two major connections, ridership activity is lower but still significant at several areas along the run. Areas of high ridership activity include:

- **New London Union Station.** The New London Union Station has an average of 91 boardings and 71 alightings.
- **Norwich Transportation Center.** The Norwich Transportation Center has an average of 144 boardings and 103 alightings.
- **Mohegan Sun.** Mohegan Sun is the busiest stop outside of the two transfer centers. In the northbound direction, there are 18 boardings and 51 alightings. In the southbound direction, 27 boardings and 36 alightings.
- **Uncas-On-Thames (Uncas Health District).** The health center has significant activity in both directions, with 25 boardings and 14 alightings in the northbound directions, and 15 boardings and 17 alightings in the southbound direction.
- **Eugene O'Neill Drive at State Street**. At State Street in New London, 30 passengers disembark on southbound trips just before the run reaches Union Station.

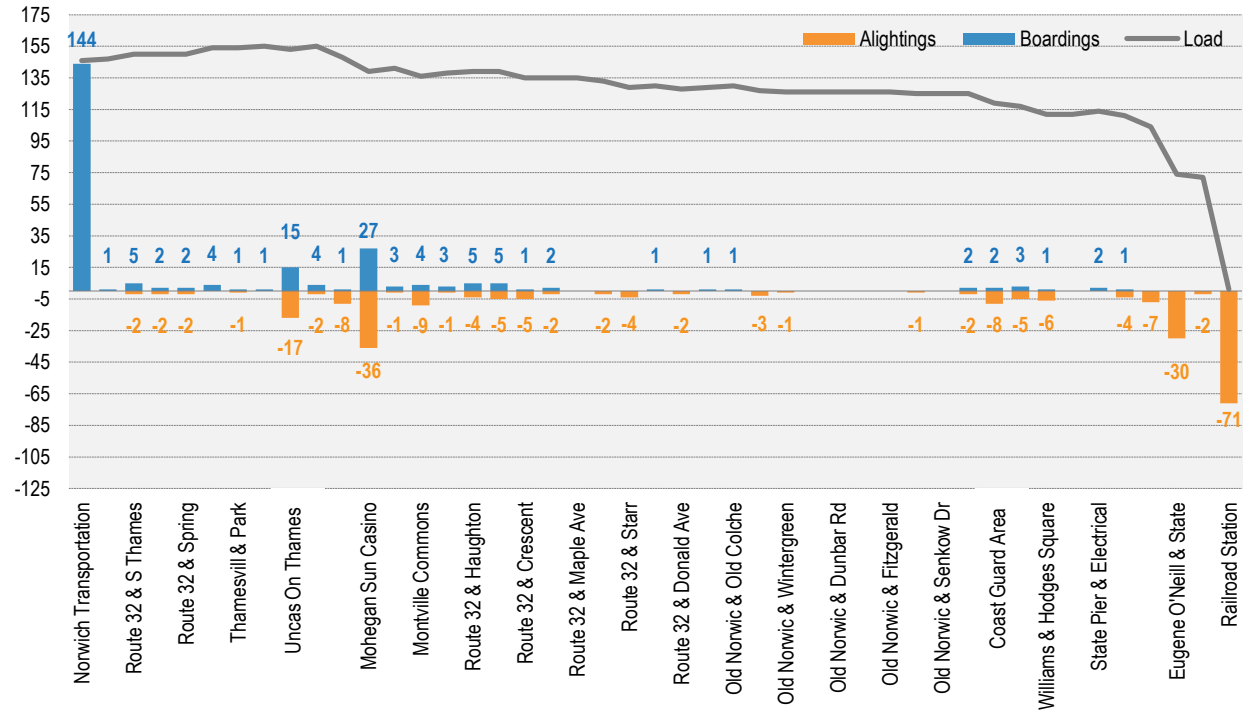
Ridership along the rest of the run is fairly low.

FIGURE 6 – NORTHBOUND WEEKDAY RIDERSHIP BY STOP CHART



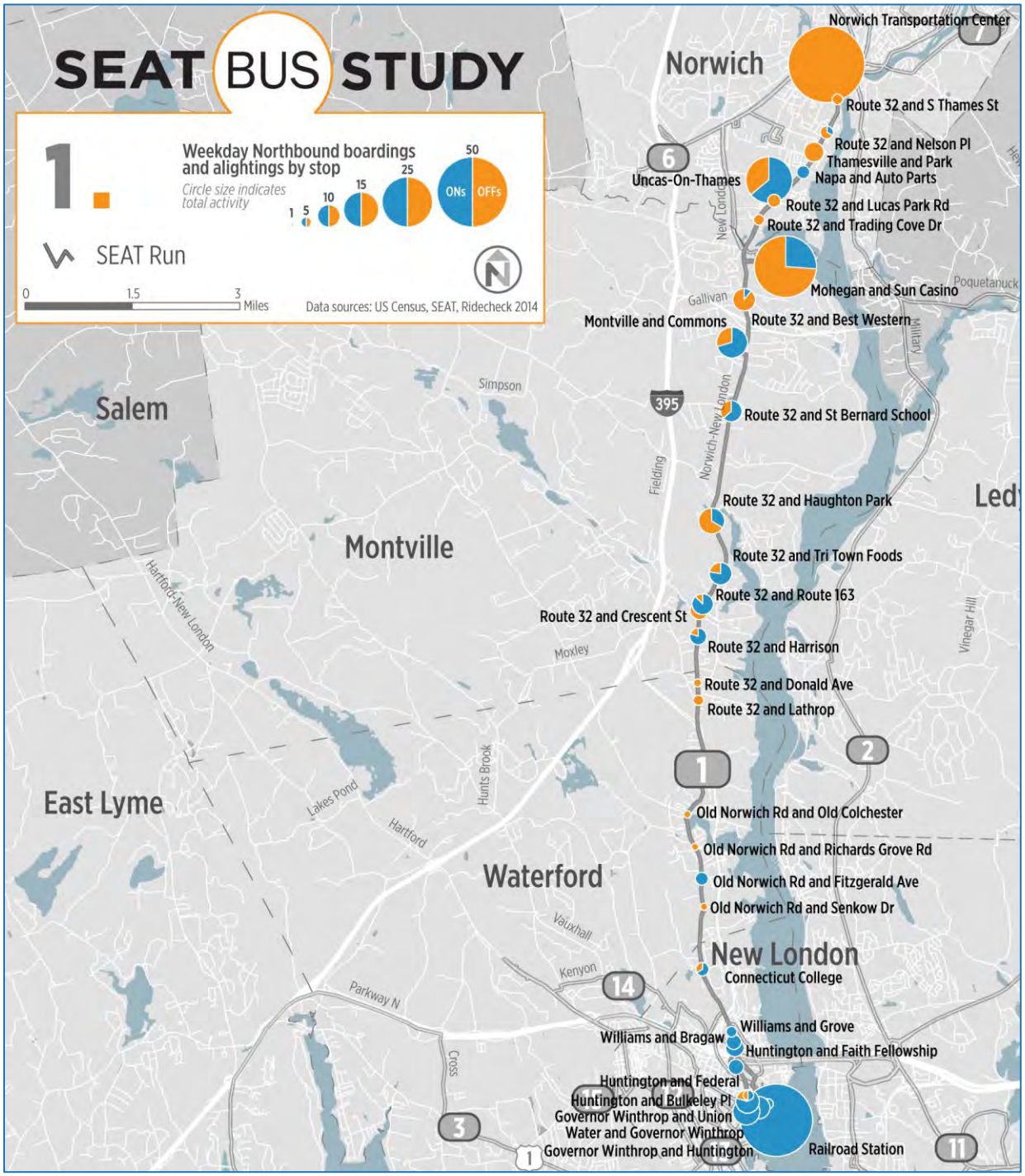
Source: SEAT Ridecheck 2014

FIGURE 7 – SOUTHBOUND WEEKDAY RIDERSHIP BY STOP CHART



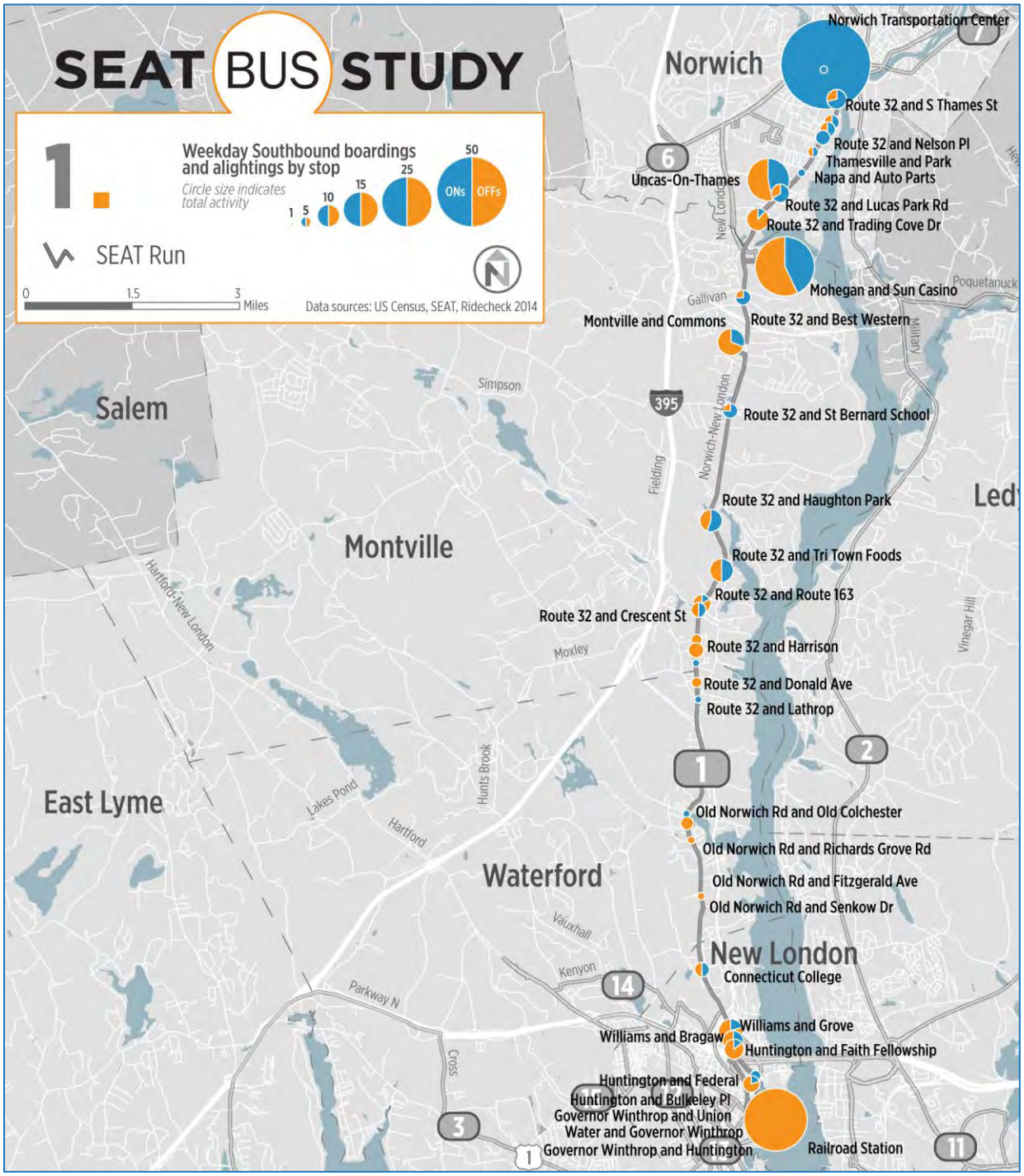
Source: SEAT Ridecheck 2014

FIGURE 8 – NORTHBOUND WEEKDAY RIDERSHIP BY STOP MAP



Source: SEAT Ridecheck 2014

FIGURE 9 – SOUTHBOUND WEEKDAY RIDERSHIP BY STOP MAP



Source: SEAT Ridecheck 2014

Ridership by Trip. Ridership by trip activity gives an indication of some general ridership trends on Run 1/101. In general, midday ridership is high; ridership is highest on Run 1/101 during the midday in the northbound direction, and during the morning peak and noon for the southbound direction (see Figure 10 and 11). The run's high ridership during the midday indicates that the run is serving a strong all-day demand and not just the typical AM and PM peak period commute market.

Ridership in the evening tapers off, especially in the southbound direction, where ridership per trip drops to 14 passengers or fewer after 6:00 PM. In the northbound directions, there is less of a pattern, with only 8 passengers on the 7:00 PM trip, but 16 on the subsequent last 9:00 PM trip.

FIGURE 10 – NORTHBOUND WEEKDAY RIDERS PER TRIP

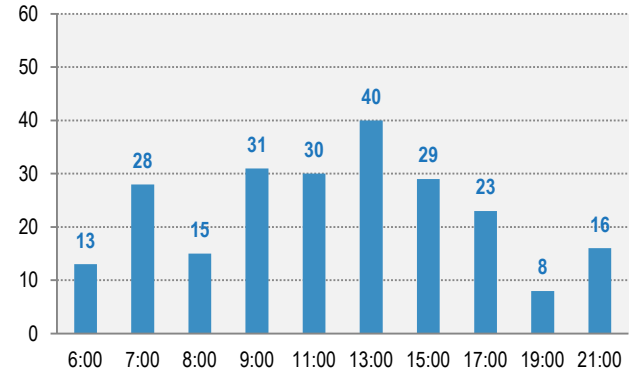
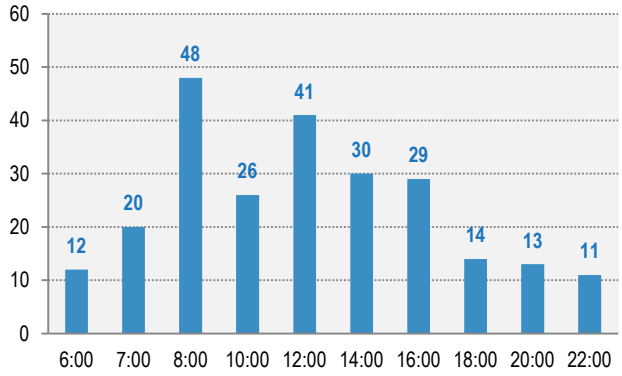


FIGURE 11 – SOUTHBOUND WEEKDAY RIDERS PER TRIP



Source: SEAT Ridecheck 2014

Performance. Overall, Run 1/101 is a productive service (see Figure 12). Run 1/101 operates above the systemwide average in terms of passengers per revenue hour, but due to the long run length, it only has an average ranking in passengers per revenue mile. Although the average operational speed is below average (at 15.1 mph versus 16.2 mph), the run has a high weekday on-time performance above the systemwide average. Sunday service likely has very low on-time performance because there is only one bus for the Run and the schedule is very tight. Saturday and Sunday's low on-time performance may be due to traffic congestion, irregular driver behavior, or an unusually late trip on the sampled days.

FIGURE 12 - PERFORMANCE MEASURES

Performance Measure	Weekday		Saturday		Sunday	
	Run 1	System Avg	Run 1	System Avg	Run 1	System Avg
Passengers per Revenue Vehicle Hour	23.9	20.9		16.4		12.9
Passengers per Revenue Vehicle Mile	1.6	1.6		1.2		0.8
Average Speed (mph)	15.1	16.2		15.2		17.6
On-Time Performance Reliability*	74.1%	57.9%	48.9%	52.8%	40.0%	40.8%

*On-Time Performance is the percent of sampled observations where the bus arrived at timepoints within 5 minutes of the scheduled time.
Source: SEAT Analysis Factors 2014

FIGURE 13 – WEEKDAY RIDERS PER REVENUE HOUR

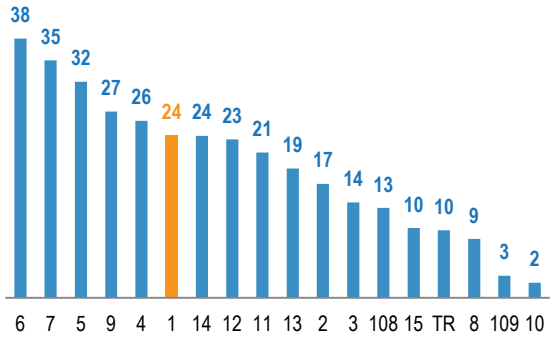
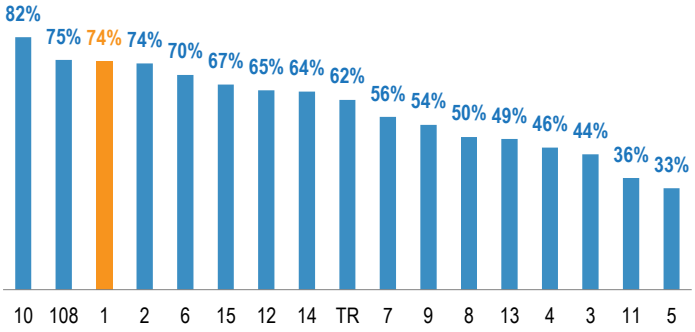


FIGURE 14 – WEEKDAY ON-TIME PERFORMANCE

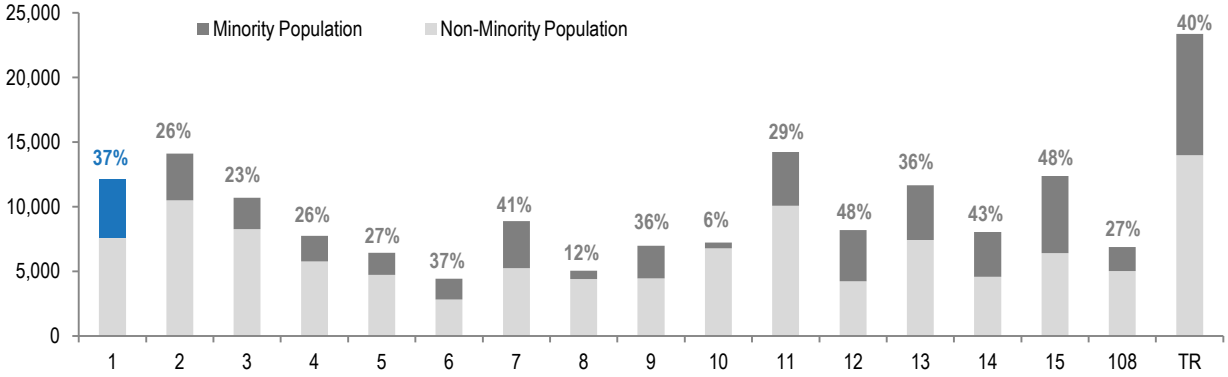


Source: SEAT Ridecheck 2014

Environmental Justice

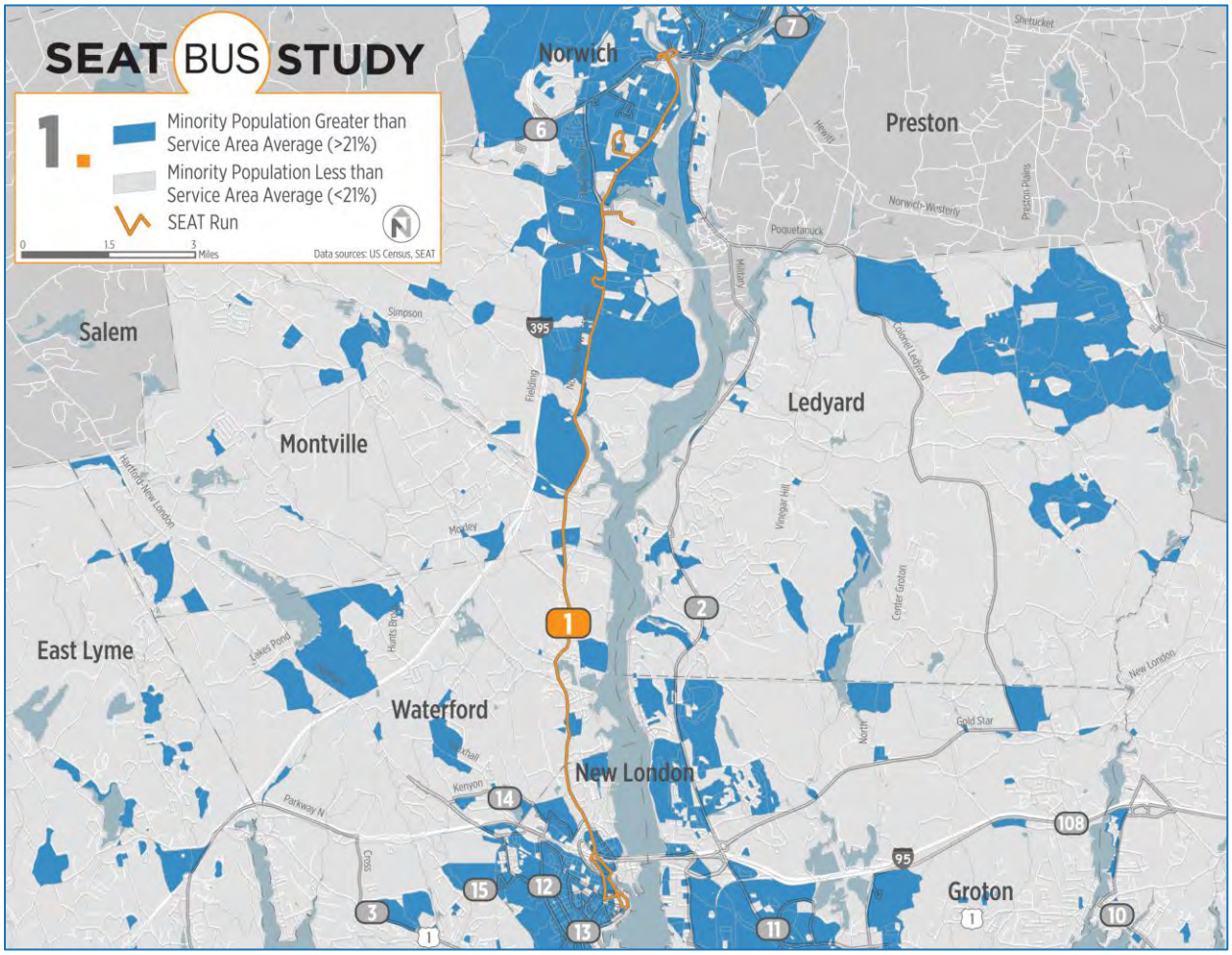
Run 1/101 predominately serves areas with a slightly higher minority population than is found in the SEAT service area overall. Over one-third (37%) of the population served by Run 1/101 lives in census blocks that have a minority population greater than the overall service area average (21%). As shown in Figure 16, these minority populations are concentrated in New London and Norwich, as well as along Route 32 in Montville.

FIGURE 15 –SERVICE TO BLOCKS WITH HIGH MINORITY POPULATIONS



Sources: US Census 2010, SEAT

FIGURE 16 – MAP OF BLOCKS WITH HIGH MINORITY POPULATIONS



Sources: US Census 2010, SEAT

SERVICE IMPROVEMENT OPTIONS

Run 1/101 is a strong performing run in the SEAT network, largely due to its role in connecting two of the regions' main city centers as well as the Mohegan Sun Casino and Connecticut College.

While Run 1/101 is productive, there are likely opportunities to improve the service and generate greater ridership. The Route 32 corridor between New London and Norwich is likely the most important corridor in the region, and Run 1/101 could be a core SEAT run, serving as a backbone for the system. Minor improvements would help the run become such an important core service. Accordingly, there are some options to improve service:

- **Redesign Run 1 and 101 as SEAT's primary core/trunk run.** Runs 1 and 101 provide service between Norwich and New London, linking the region's two most active centers and providing a critical and regionally important service. Runs 1 and 101 could be combined into a single consolidated core trunk run that would serve as the "backbone" of the SEAT system. Such a redesign would involve several components:
  - **Operate Run 1 and Run 101 as a single run.** Runs 1 and 101 provide service on the same alignment between Norwich Transportation Center and the New London Union Station, yet are operated as separate runs. This is a major source of confusion for riders unfamiliar

with the service, as new riders would need to consult two schedules and service descriptions to understand the combined service they offer. In addition, riders may not be aware of the supplemental service offered by 101 runs and assume the corridor has half the level of service that is actually offered during the peaks. Run 1 and 101 could be operated as a single run with a consolidated schedule, which would reduce confusion and increase the usability and attractiveness of service.

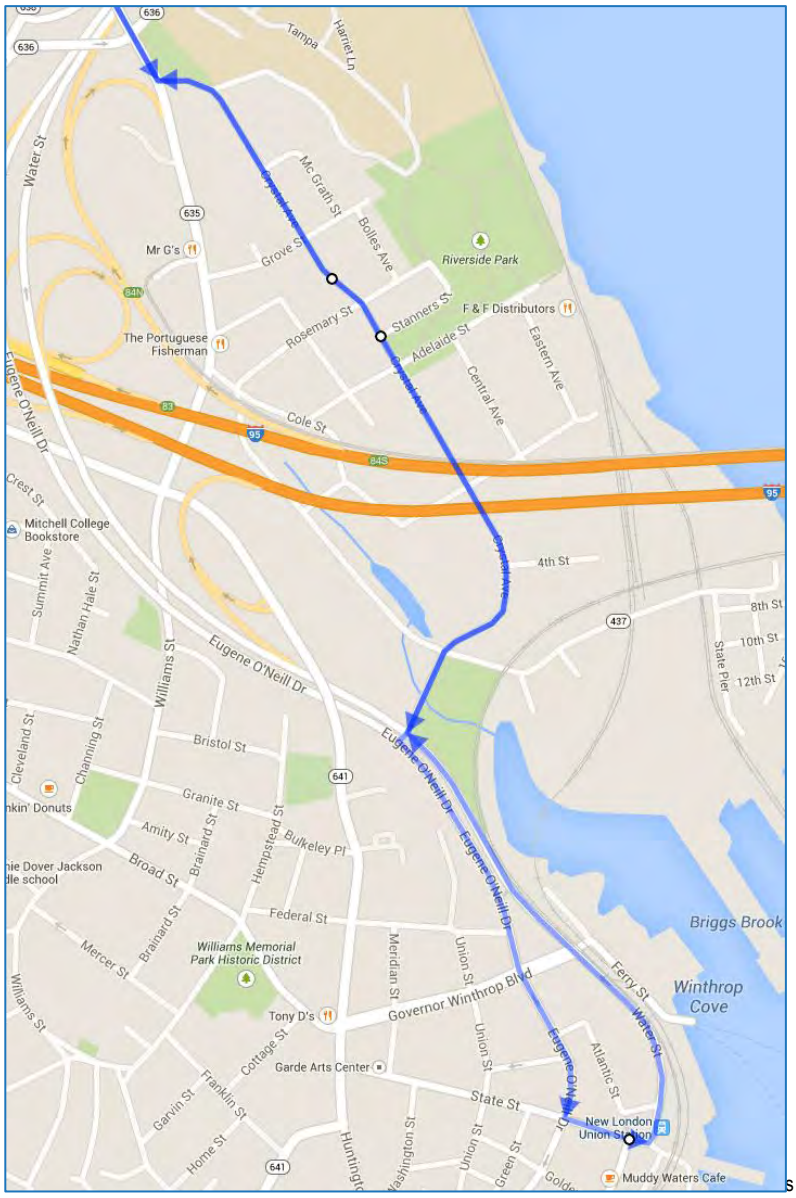
  - **Set a consistent all-day frequency.** As the most critical run in the system, Run 1/101 should be very easy to understand and use. Run 1/101 could be set to a frequency that would be consistent throughout the entire service day, such as 60-minute service all day, every day.
  - **Discontinue deviations.** Run 1/101 would focus on its primary market of providing core trunk service that would be fast and direct, and deviations from the main corridor could be discontinued.

- **Increase service frequency.** Run 1/101 may be the most critical service in the SEAT system, providing a link between New London and Norwich along Route 32, not only serving these city centers but also regional institutions such as Connecticut College, the U.S. Coast Guard Academy, and Mohegan Sun Casino. Such an important service should operate more frequently, providing service at least hourly all day.
- **Supplement with true New London–Norwich express trips.** Run 1/101 can be supplemented with true express service between New London and Norwich, via the fastest route between the two (likely I-395), with just a single interim stop at Mohegan Sun. A one-way trip on such a service would take about 25 minutes, which would be an attractive alternative to driving.
- **Improve Schedule Cards, Maps, and Branding.** Runs 1 and 101 serve some major institutions, such as Connecticut College and the United States Coast Guard Academy, but there is currently little to no ridership at these places. College students are usually willing to try alternative transportation options, yet the current schedules and maps are confusing and may be a deterrent to student populations. The schedules show both directions of service in the same column without any differentiation of which direction the bus is traveling. The street listings also go in the opposite direction of what is listed on the schedule (the street listing has southbound and then northbound while the schedule has the opposite with northbound first followed by southbound). Also, the listing of timepoints is confusing as many stops have several different names (New London/Water Street is listed as Train Station on other schedules). The public maps are unclear and confusing. Improved branding and public information would go a long way to helping potential riders understand and use the system, including college students, visitors, and the general public.
- **Discontinue diversion into Montville Commons.** Run 1/101 makes a diversion from Route 32 to serve Montville Commons in Montville, a commercial shopping center with a Home Depot and Stop & Shop, however ridership activity at the center is relatively low (only 3% of the run's activity). The relatively low ridership activity may not justify the diversion, which slows down through travel times for the overwhelming majority of riders who ride through the area. If the diversion were discontinued and the bus simply traveled through on Route 32, riders wishing to travel to Montville Commons could board and alight on Route 32, which is less than ¼-mile to the front door of all businesses in the center (and there are signalized pedestrian crossings across Route 32 at both Montville Commons Road and Occum Lane, though the sidewalk network may need to be better connected for an improved pedestrian connection).
- **Serve Uncas-On-Thames health center with an alternative run.** Run 1/101 makes a diversion from West Thames Street in Norwich to serve the front door of the Uncas-On-Thames health center. While ridership activity at the center is relatively high for a single location (7% of the run's activity), the center could be served with an alternate run, allowing Run 1/101 to focus

on its most important market of fast and direct core service between New London and Norwich. The diversion adds nearly five minutes to the through travel time of the run, inconveniencing the overwhelming majority of riders who ride through. The health center's ridership activity probably justifies service, but the ridership does not justify diverting what is probably the most important run in the system, Run 1/101.

- **Re-align New London service alignment.** Run 1/101 currently provides service into and out of New London via Eugene O'Neill Drive southbound and Huntington Street northbound, forming a one-way loop through the city center and diluting service onto two one-way segments, which is less useful for riders. Instead of diluting service operating this run on two one-way service corridors, both directions of service could be consolidated onto the same alignment, providing more attractive bidirectional service to riders. One service option utilizing this strategy would be to operate both directions of service on Crystal Avenue and Eugene O'Neill Drive/Water Street in both directions (see Figure 17).

FIGURE 17 – POSSIBLE REALIGNMENT IN NEW LONDON

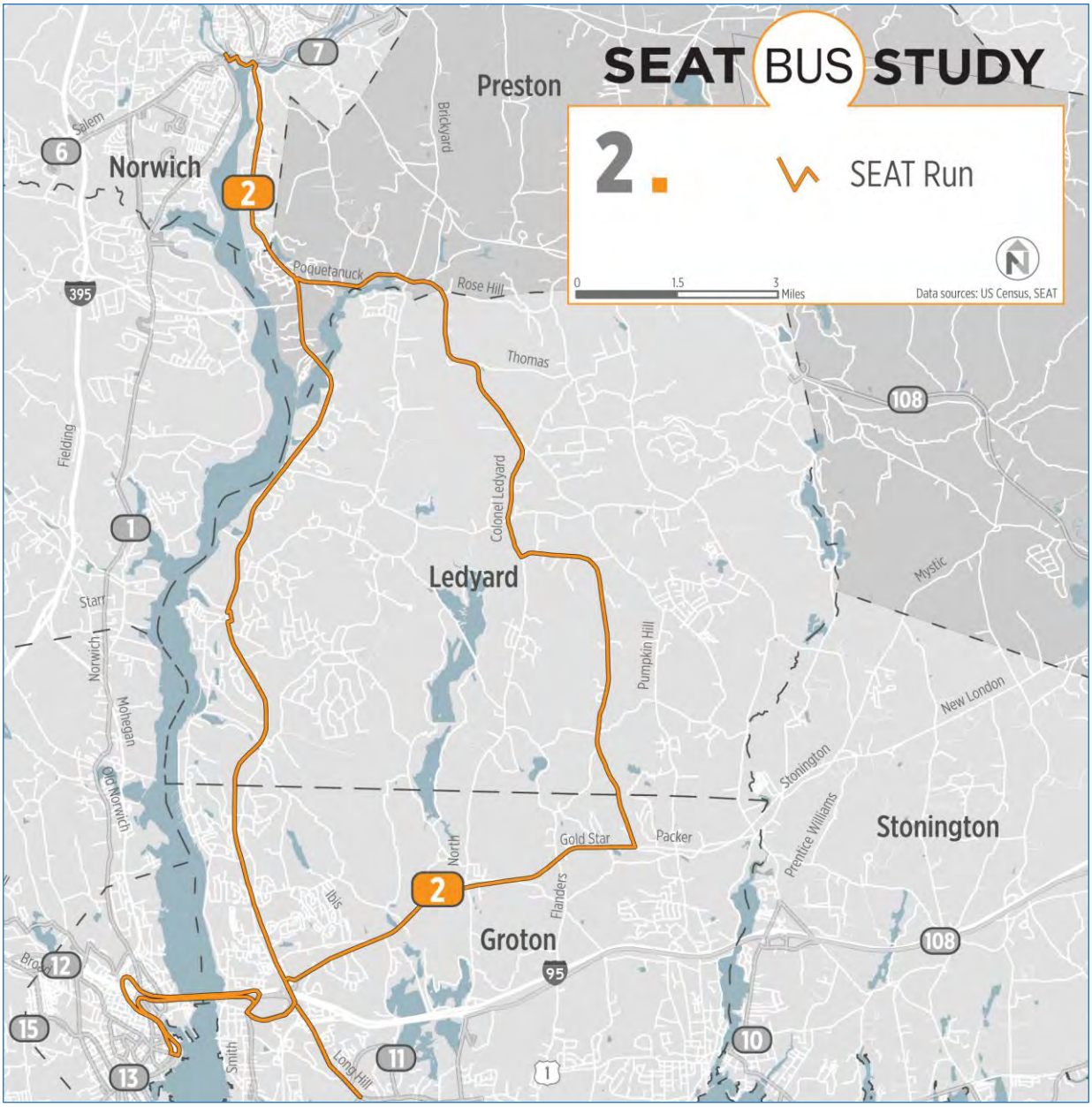


SERVICE EVALUATION

RUN 2 (NORWICH / GROTON / NEW LONDON / ROUTE 12)

Service Design. Run 2 is a coverage-focused run that serves Ledyard and Groton, connecting both towns to Norwich and New London along the east side of the Thames River. The run serves the Norwich Transportation Center and New London Union Station, as well as Ledyard Center, Route 12, and the

FIGURE 1 – RUN MAP



Groton Square and Plaza Court shopping centers. The run operates along different alignments in the northbound and southbound directions, such that most stops are served only in one direction. Southbound service departs the Norwich Transportation Center and travels briefly on Route 12, then turns south onto Colonel Ledyard Highway. The run continues south on Col. Ledyard Highway through Ledyard, stopping in Ledyard Center and continuing through the northern portion of Groton. The run continues west along State Route 184 and stops at Groton Square shopping center, turns south back onto Route 12 and Long Hill Road, stopping at Plaza Court shopping center, and returns north on Long Hill Road and travels into New London.

Northbound buses follow a different alignment for most of their trip. Buses travel out of New London and travel northbound primarily along onto Route 12. Buses stop at Groton Square shopping center, and then continue north along Route 12 with stops at the Naval Submarine Base in Groton and at Ocean State Job Lot in Ledyard. Buses terminate at the Norwich Transportation Center. On the first and last trips of the day, southbound buses follow the northbound alignment along Route 12 in reverse to New London, and follow the same alignment back north to Norwich.

Service Schedule. Run 2 has a simple schedule with a consistent but low frequency of service. The run operates every two hours, departing Norwich Transportation Center and Water Street near New London Union on alternating hours. The run operates six days per week (Mondays and Saturdays), and operates on the same schedule every day, operating a total of 12 daily one-way trips (Figure 2). The first and last southbound trips (7:00 a.m. and 5:00 pm) follow a different alignment, traveling south along Route 12 instead of Col. Ledyard Highway and Route 184.

FIGURE 2 - SCHEDULE STATISTICS

Service Day	Span of Service	Frequency (min) Peak / Off-Peak	Daily Trips
Weekday	7:00 AM — 6:00 PM	120	12
Saturday	7:00 AM — 6:00 PM	120	12
Sunday	-	-	-

Source: SEAT Run Schedules

Interaction with System. The alignment of Run 2 does not overlap with any other SEAT run, although passengers can connect with other SEAT runs at key areas along Run 2:

- **Norwich Transportation Center:** Passengers can connect to SEAT runs 1, 4, 5, 6, 7, and 9. Run 1/101 also provides service between Norwich and New London, but along the west side of the Thames River via Montville Commons and Mohegan Sun.
- **New London Union Station:** Passengers can connect to SEAT runs 1, 3, 12, 13, 14, 15, and 108.
- **Plaza Court:** Run 2 stops at Plaza Court in Groton, connecting with Run 11 and Run 108.

Ridership by Service Day. Run 2 carries an average of 201 passengers per weekday, which is relatively low compared to other SEAT runs (see Figures 3 and 4). On Saturdays, Run 2 averages 125 daily passengers, which is near the middle compared to other SEAT runs and is above the Saturday average (see Figure 3). In terms of ridership per trip, Run 2 performs above average: 16.8 passengers per trip on weekdays, above the system average of 13.0, and 10.4 passengers per trip on Saturdays, slightly above the system average of 9.5 (see Figure 5).

FIGURE 3 - RIDERSHIP STATISTICS

Service Day	Daily Ridership	Ridership per Trip	
	Run 2	Run 2	System Avg
Weekday	201	16.8	13.0
Saturday	125	10.4	9.5
Sunday	-	-	5.8

Source: SEAT Ridecheck 2014

FIGURE 4 - AVERAGE WEEKDAY RIDERSHIP

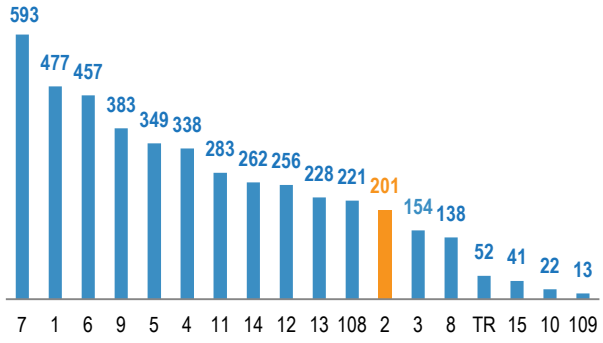
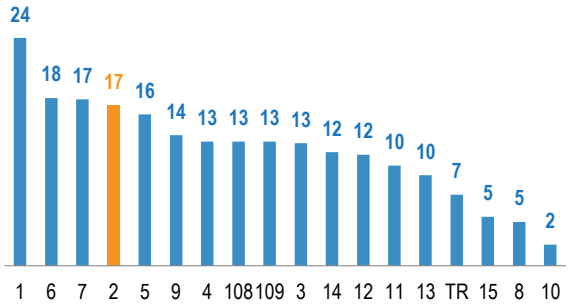


FIGURE 5 - AVERAGE WEEKDAY RIDERSHIP PER TRIP



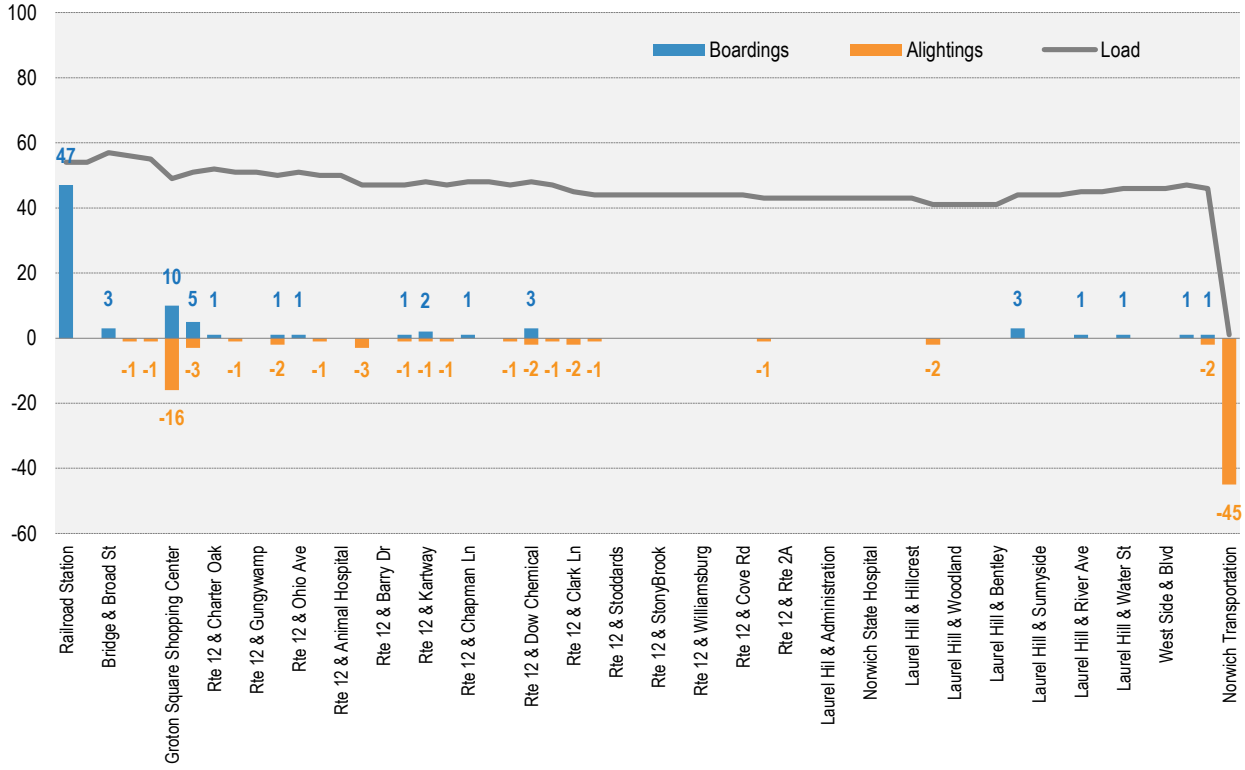
Source: SEAT Ridecheck 2014

Ridership by Stop. Ridership on Run 2 varies widely in different areas of its alignment. Areas with high concentrations of ridership include:

- **Transit Centers.** Norwich Transportation Center has an average of 67 boardings and 45 alightings, while New London Union Station has 47 boardings and 53 alightings.
- **Groton Square Shopping Center.** Groton Square averages 10 boardings and 16 alightings along Run 2 northbound. This shopping center features a Super Stop & Shop and several retail stores, and is adjacent to a Wal-Mart and a hotel.
- **Plaza Court.** This stop has an average of 13 boardings and 14 alightings. Plaza Court is surrounded mostly by commercial uses, including a discount supermarket and several retail stores, and is adjacent to the Groton Plaza shopping center (on Long Hill Road). It is also in close proximity to Groton Shoppers Mart shopping center and Poquonnock Village apartment complex, both on Poquonnock Road. Here, riders can connect to Run 11 and Run 108.

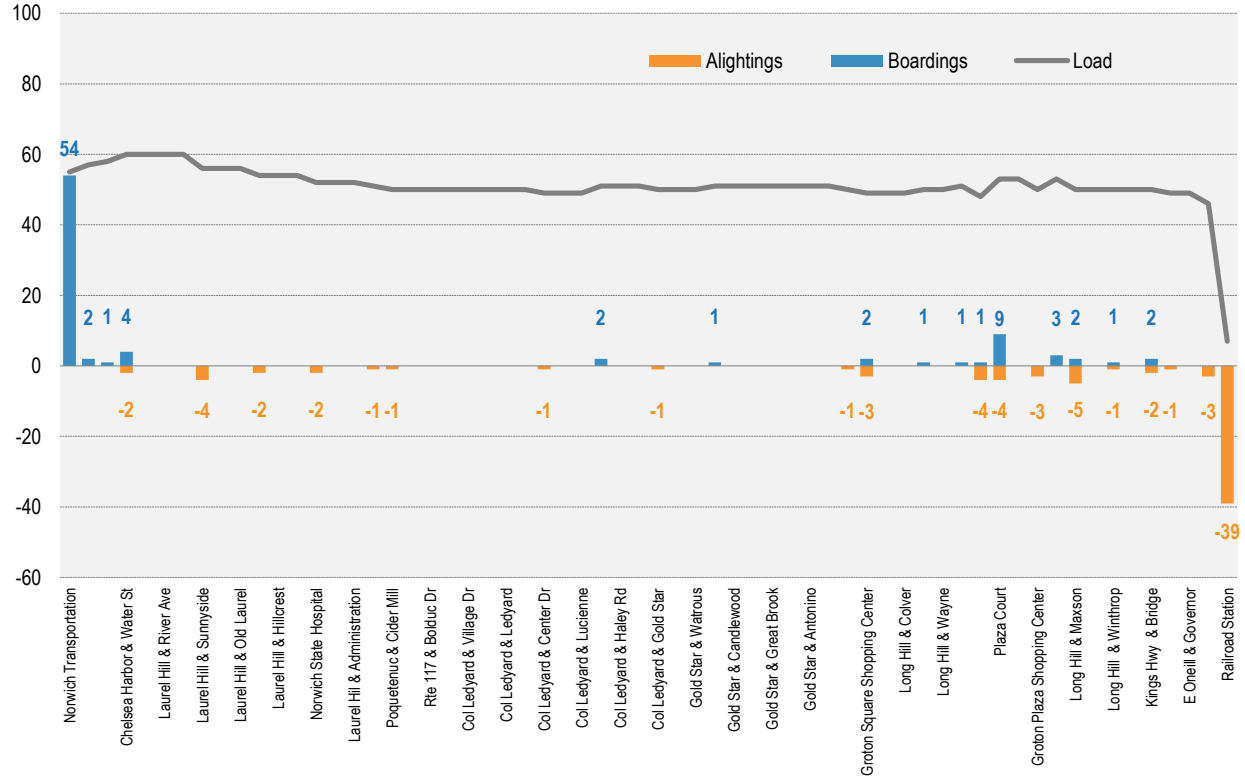
Ridership along most of Run 2 is relatively low, especially compared with the distance traveled. In fact, over 90% of Run 2's boarding and alighting activity occurs in Norwich, Groton, and New London. This indicates that the Route 12 and Colonel Ledyard Highway segments of the run generate very few riders (see Figure 9).

FIGURE 6 – NORTHBOUND WEEKDAY RIDERSHIP BY STOP CHART



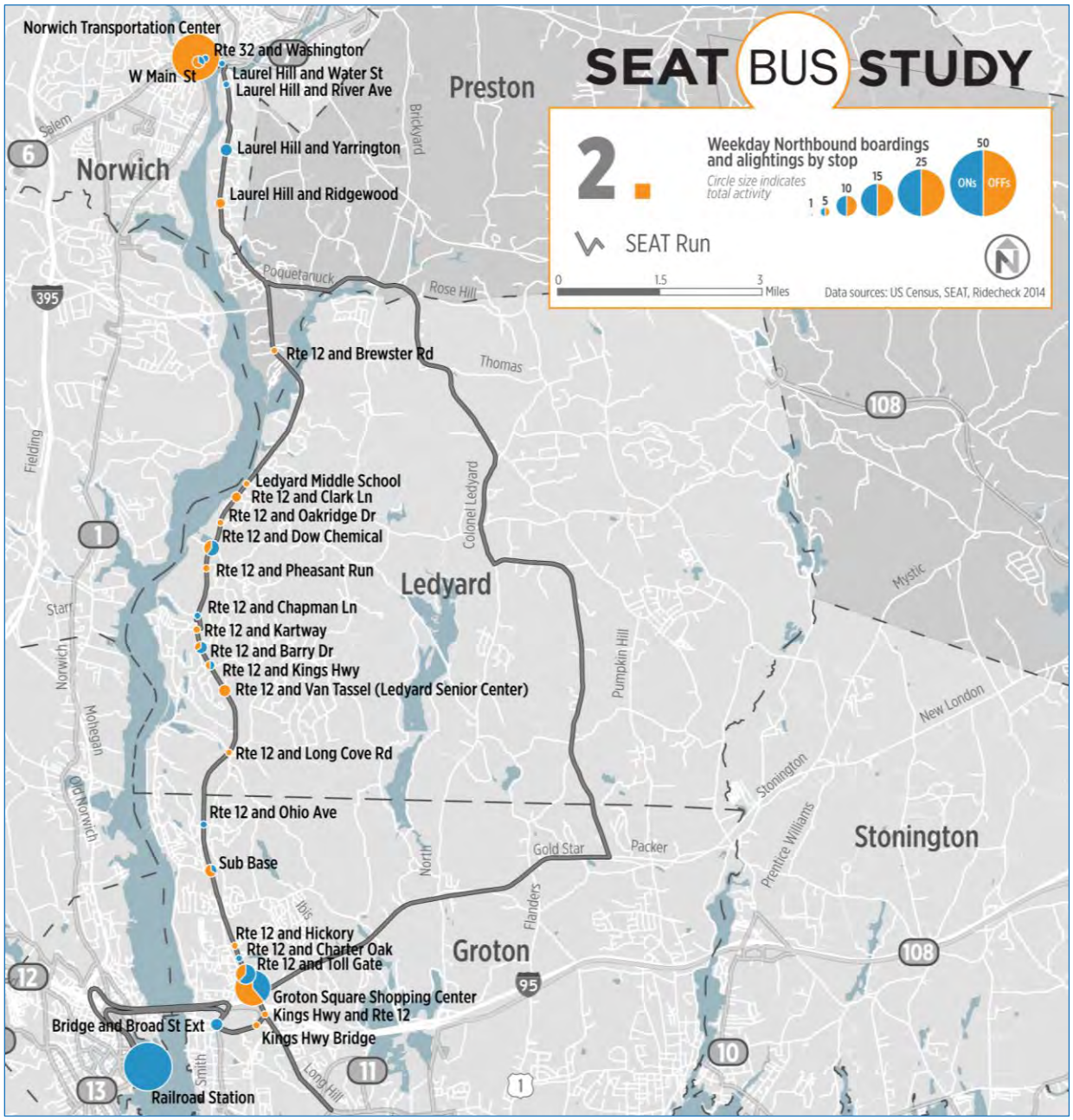
Source: SEAT Ridecheck 2014

FIGURE 7 – SOUTHBOUND WEEKDAY RIDERSHIP BY STOP CHART



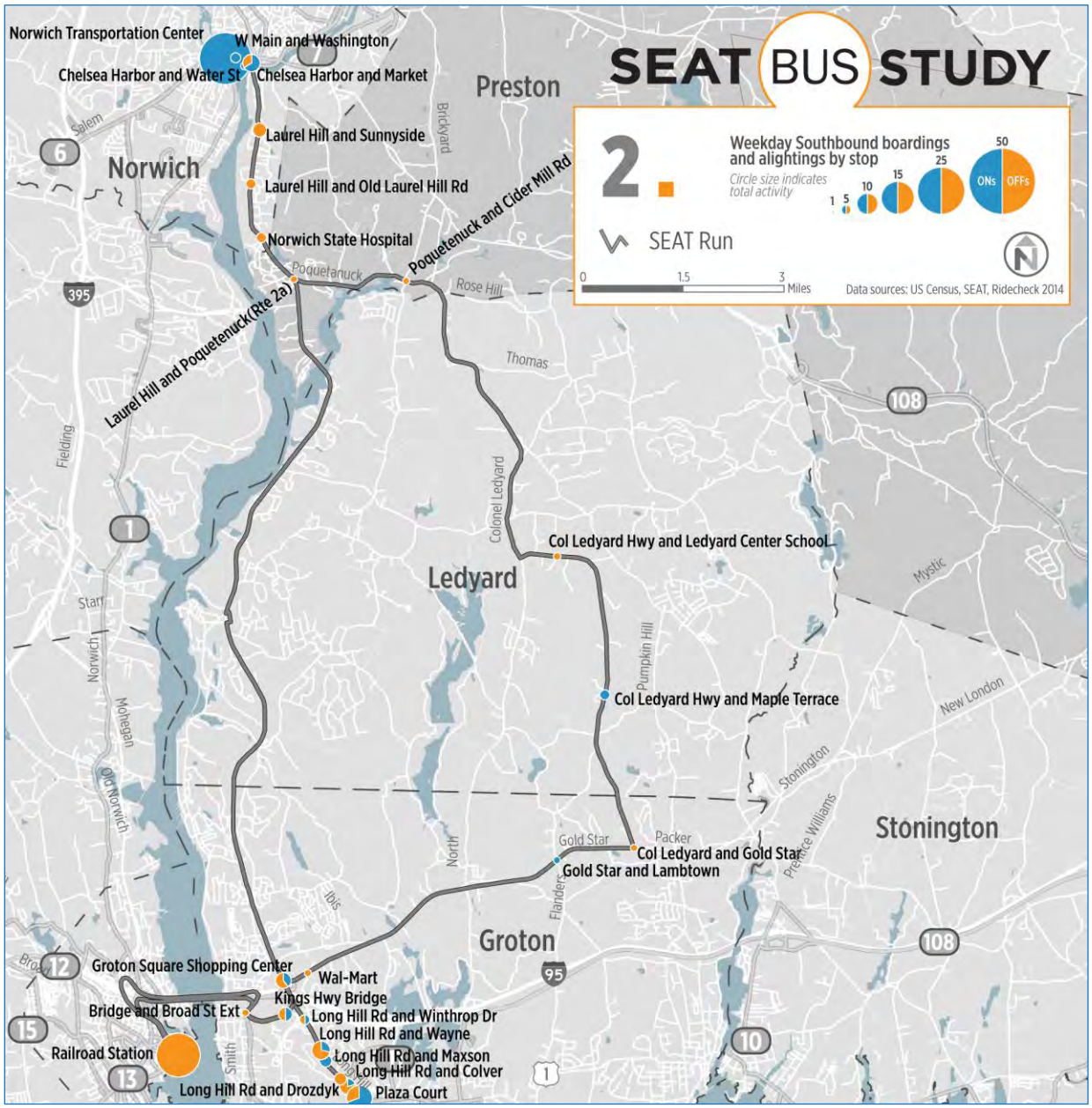
Source: SEAT Ridecheck 2014

FIGURE 8 – NORTHBOUND WEEKDAY RIDERSHIP BY STOP MAP



Source: SEAT Ridecheck 2014

FIGURE 9 – SOUTHBOUND WEEKDAY RIDERSHIP BY STOP MAP



Source: SEAT Ridecheck 2014

Ridership by Trip. Weekday Ridership per trip on Run 2 is generally higher traveling southbound than northbound (see Figure 10 and Figure 11). Northbound ridership is higher in the morning and tapers off during the course of the day, with the exception of the 2 PM trip, which has the highest northbound ridership per trip (19 passengers). Southbound ridership per trip is somewhat stronger, with higher ridership (23 to 25 passengers per trip) in the late morning and early afternoon. The last southbound trip also performs relatively well, carrying 20 passengers per trip. (Note that the first and last southbound trips travel along Route 12 instead of the run's usual southbound alignment.)

FIGURE 10 – NORTHBOUND WEEKDAY RIDERS PER TRIP

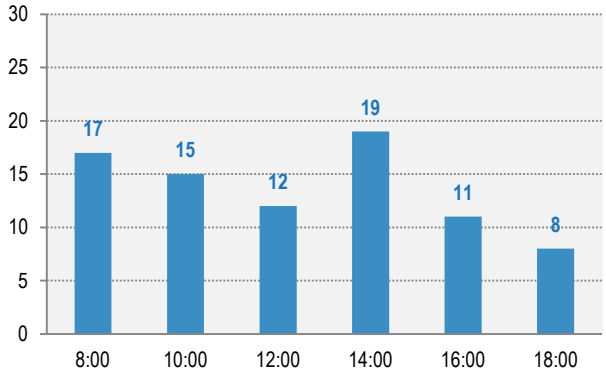
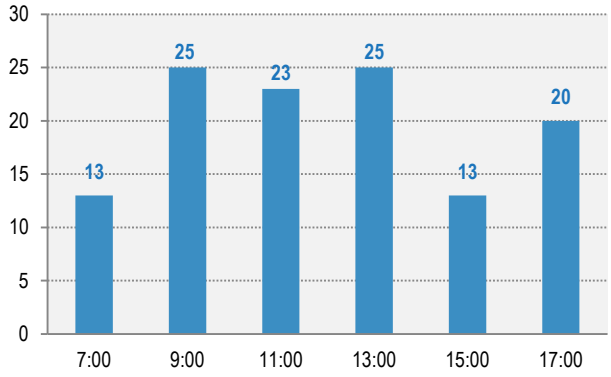


FIGURE 11 – SOUTHBOUND WEEKDAY RIDERS PER TRIP



Source: SEAT Ridecheck 2014

Performance. Overall, Run 2 performs lower than average among SEAT runs (see Figure 12). Although the run has better than average total daily ridership, Run 2 carries a lower volume of passengers per revenue hour than the system average on weekdays and Saturdays, and about half the average volume of passengers per revenue mile. On both measures, Run 2 ranks 11th out of 18 runs on weekdays and 12th out of 14 runs on Saturdays.

One area where Run 2 performs relatively well is average speed, where the run operates well above the average system speed on all days. On this measure, Run 2 ranks 5th out of 18 on weekdays and 2nd out of 14 on Saturdays. This is largely because the run travels along relatively high speed highways for much of its alignment.

Run 2 performs above the system average in terms of weekday on-time performance, and at 74% on time is only slightly below Run 10, which has the highest on-time performance in the SEAT system (see Figure 14). However, on-time performance is lower on Saturdays: at 48.5%, Run 2 Saturday on-time performance is far below weekday levels and slightly below the Saturday system average of 52.8%.

FIGURE 12 - PERFORMANCE MEASURES

Performance Measure	Weekday		Saturday		Sunday	
	Run 2	System Avg	Run 2	System Avg	Run 2	System Avg
Passengers per Revenue Vehicle Hour	16.8	20.9	10.4	16.4	-	12.9
Passengers per Revenue Vehicle Mile	0.8	1.6	0.5	1.2	-	0.8
Average Speed (mph)	20.0	16.2	20.0	15.2		17.6
On-Time Performance Reliability*	73.5%	57.9%	48.5%	52.8%	-	40.8%

*On-Time Performance is the percent of sampled observations where the bus arrived at timepoints within 5 minutes of the scheduled time.
Source: SEAT Analysis Factors 2014

FIGURE 13 – WEEKDAY RIDERS PER REVENUE HOUR

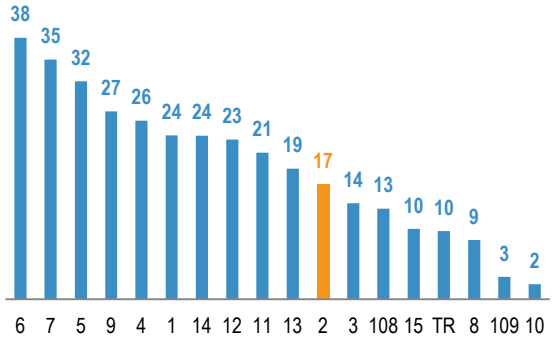
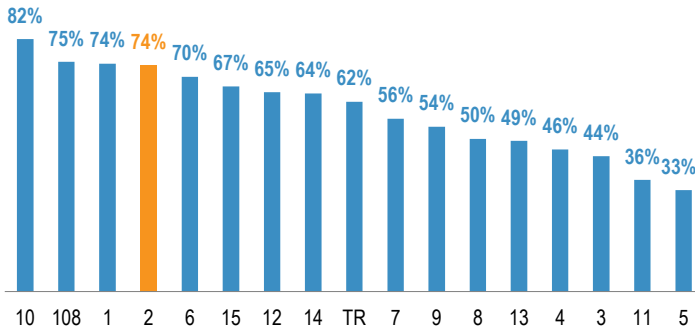


FIGURE 14 – WEEKDAY ON-TIME PERFORMANCE



Source: SEAT Ridecheck 2014

Environmental Justice

Run 2 predominately serves areas with a slightly higher minority population than is found in the SEAT service area overall. About one-quarter (23%) of the population served by Run 2 lives in census blocks that have a minority population greater than the overall service area average (21%). As shown in Figure 16, these minority populations are concentrated in New London, Groton, and Norwich, as well as Gales Ferry in Ledyard.

FIGURE 15 – SERVICE TO BLOCKS WITH HIGH MINORITY POPULATIONS

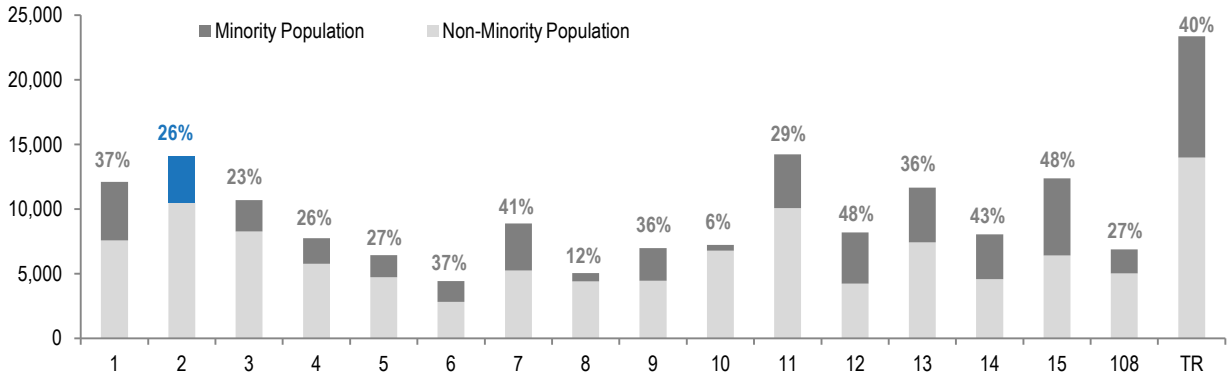
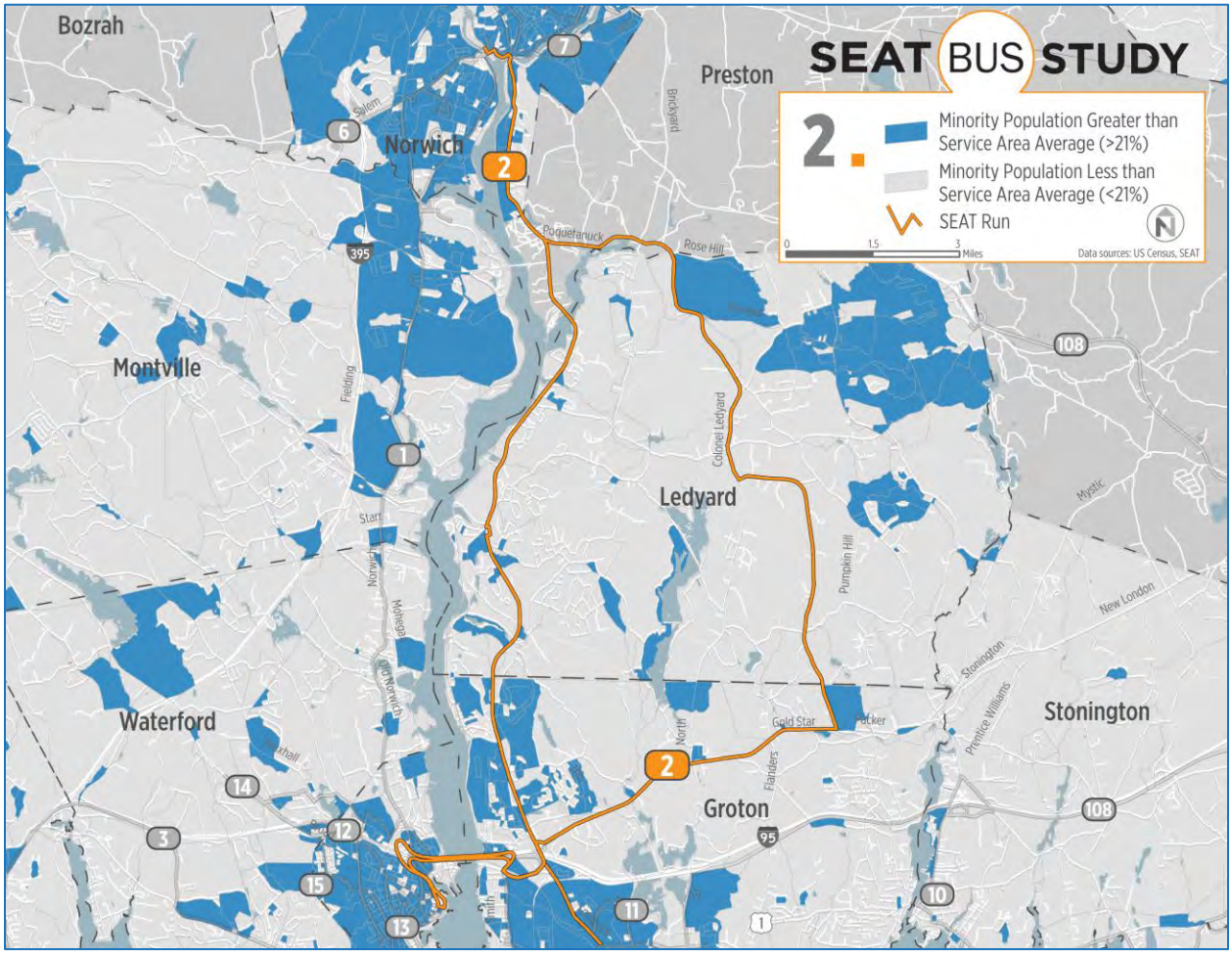


FIGURE 16 – MAP OF BLOCKS WITH HIGH MINORITY POPULATIONS

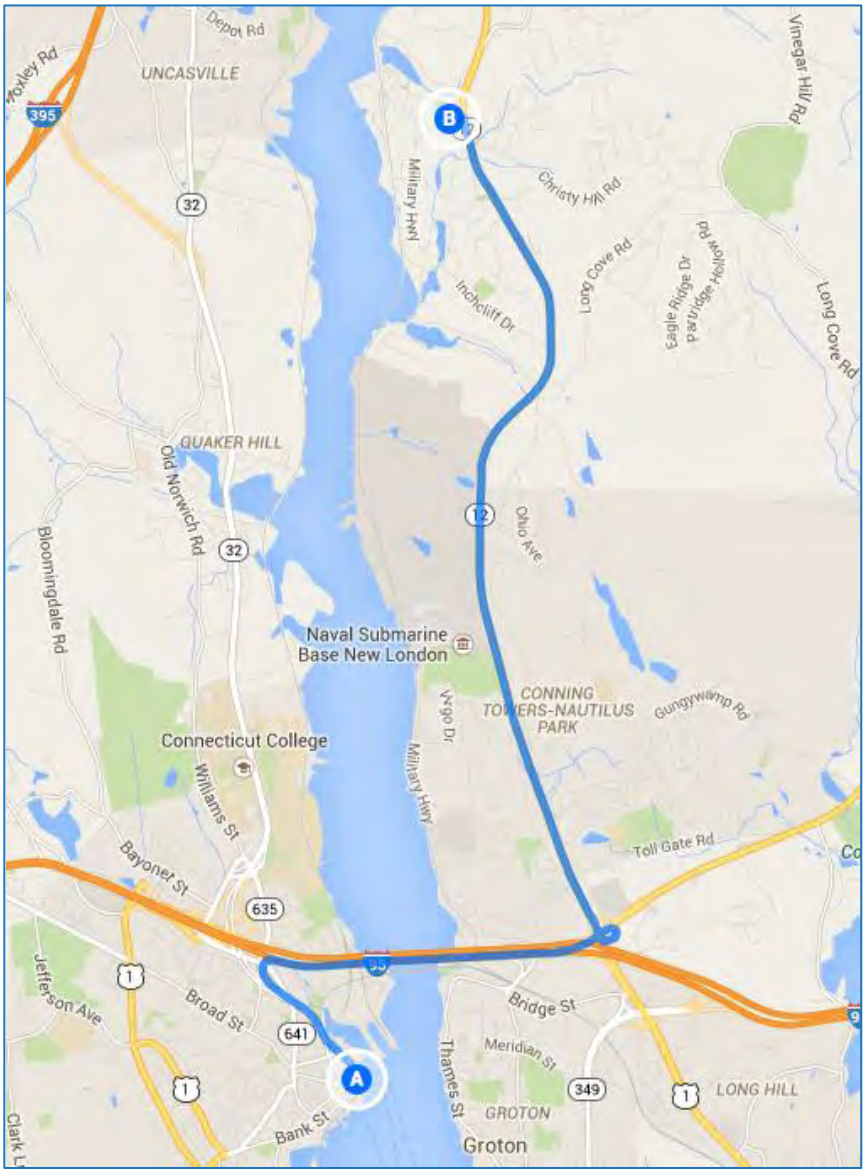


SERVICE IMPROVEMENT OPTIONS

Run 2 is a somewhat productive run, though this is entirely due to the New London, Groton, and Norwich segments; Run 2's main service market of Route 12 and Colonel Ledyard Highway generates almost no riders, yet the run uses considerable resources traveling through these unproductive areas. In addition, the run's alignment is asymmetrical and confusing for riders, and the frequency of service is low (once every two hours). However, the run does have a few strengths: the northbound (Route 12) alignment is relatively direct and operates along a major thoroughfare, and service in both directions lacks significant deviations. There are a number of opportunities to improve service:

- **Consolidate Run 2 with other runs.** Over 95% of the run's ridership activity occurs in Norwich, New London, and Groton, in locations that duplicate other service or that are near other service. Run 2 could be consolidated with these other runs, with modifications to them to capture areas that would otherwise lose service. It should be relatively easy to consolidate with other runs and save resources while maintaining service to over 90% of the existing riders.
- **Redesign the run to provide bidirectional service.** Run 2 operates along significantly different alignments in the northbound and southbound directions, forcing passengers to travel the entire length of the run in order to complete a round trip. The run could be redesigned to operate along the same alignment in both directions, which would make it easier for riders to use for complete trips. The most direct and productive alignment option would be to use Route 12.
- **Consider adding an additional southbound trip.** The increased level of ridership on the 5 PM southbound trip (which serves Route 12 instead of Ledyard Highway and Route 184) indicates that there may demand for an additional southbound trip at 6 PM or 7 PM.
- **Redesign Run 2 to focus on the most productive segment of Route 12.** Run 2 could be redesigned to maintain service in New London and Groton, while serving only the most productive segment of Route 12 in Ledyard. The most productive market for Run 2 would be to serve Union Station in New London and Route 12 from the I-95 bridge north to the Ocean State Job Lot Plaza in Ledyard (see Figure 15). This new run design may be short enough to provide more frequent service on the run with the same resources spent on the run today.

FIGURE 15 – SERVICE REDESIGN OPTION

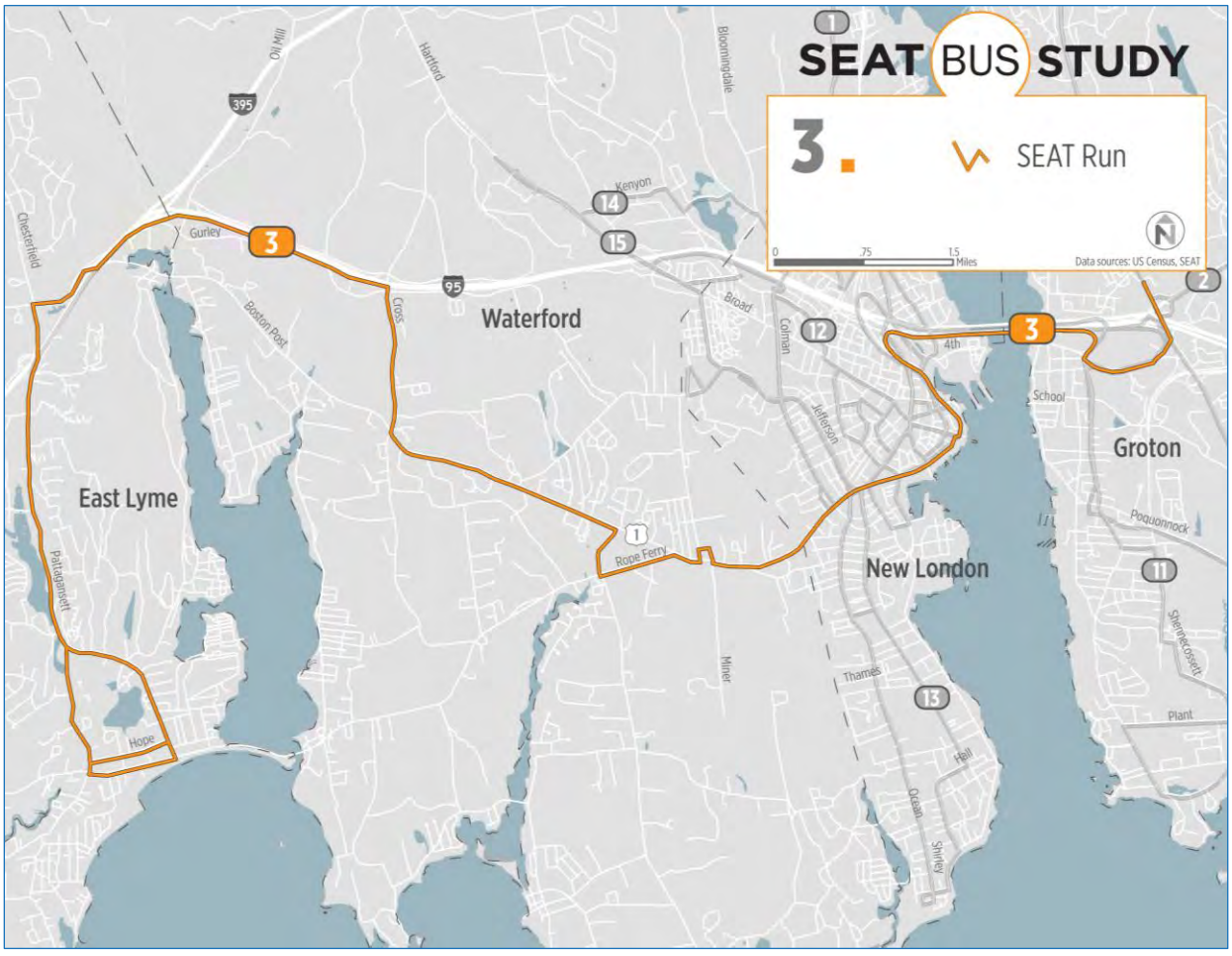


SERVICE EVALUATION

RUN 3 (GROTON / NEW LONDON / NIANTIC)

Service Design. Run 3 provides east-west service between Groton, New London, Waterford, and East Lyme. Key destinations include New London Union Station, Groton Square shopping center, Stop & Shop, Wal-Mart and Loews at Parkway North, the Waterford Cancer Center off Cross Road, and the Village of Niantic. The run provides bi-directional service along most of its alignment, except for a small terminal loop in Niantic. Outbound trips originate on Water Street near New London Union Station, and travel along Water Street and east over the Gold Star Memorial Bridge across to the Groton Square shopping center. After stopping at Groton Square, Run 3 follows the same alignment back west into New London and continues west to Niantic along Bank Street, US 1/Boston Post Road, Cross Road, I-95/Connecticut Turnpike, and State Route 161/Flanders Road. Two westbound trips per day stop at the AHEPA Housing senior living community in Waterford, a one-mile deviation off of Boston Post Road just after Stop & Shop. Eastbound buses follow the identical

FIGURE 1 – RUN MAP



alignment along Boston Post Road and Bank Street back to New London, terminating at Water Street by Union Station.

At 5:00 PM, the last Run 3 trip of the day follows a different alignment, traveling from Groton Square shopping center north along Route 12 towards the Norwich Transportation Center. This effectively serves as a deadhead trip that carries some riders to Norwich. The last "eastbound" trip actually begins at the Ocean State Job Lot along Route 12, and terminates at the Norwich Transportation Center instead of New London.

Service Schedule. Run 3 operates on weekdays only, with service running every two hours. Buses depart New London/Water Street every two hours beginning at 7:00 AM, with the last round trip beginning at 3:00 PM. The run provides a total of 12 one-way trips per day (see Figure 2). The average one-way trip is approximately 17.1 miles in length.

FIGURE 2 – SCHEDULE STATISTICS

Service Day	Span of Service	Frequency (min) Peak / Off-Peak	Daily Trips
Weekday	7:00 AM — 5:30 PM	120	12
Saturday	-	-	-
Sunday	-	-	-

Source: SEAT Run Schedules

Interaction with System. Run 3 provides connections to other SEAT runs at a few key transfer points, and operates in parallel with some runs in New London:

- **New London Union Station:** Passengers can connect to SEAT runs 1, 2, 12, 13, 14, 15, and 108. Service is timed to pulse every hour on the hour at New London.
- **Groton Square:** The Groton Square shopping center is also served by SEAT runs 2, 11 and 108. There are timed connections between Run 3 and Run 11, while Run 2 stops at Groton Square 15 minutes after this connection. Runs 3, 2 and 108 all provide service across the Gold Star bridge into New London.
- **Bank Street:** Run 3 operates east and west service along Bank Street in New London, west of Tilley Street. Runs 12 and 14 also operate along this stretch of Bank Street, while Runs 13 and 15 intersect with Bank Street and operate along it for brief segments.

Ridership by Service Day. Run 3 is less productive than other SEAT runs (see Figures 3 and 4). Average weekday ridership is 154 passengers, which is one of the lowest daily ridership levels in the SEAT system, and ridership per trip is 12.8, slightly below the SEAT weekday average (see Figure 5).

FIGURE 3 – RIDERSHIP STATISTICS

Service Day	Daily Ridership	Ridership per Trip	
	Run 3	Run 3	System Avg
Weekday	154	12.8	13.0
Saturday	-	-	9.5
Sunday	-	-	5.8

Source: SEAT Ridecheck 2014

FIGURE 4 – AVERAGE WEEKDAY RIDERSHIP

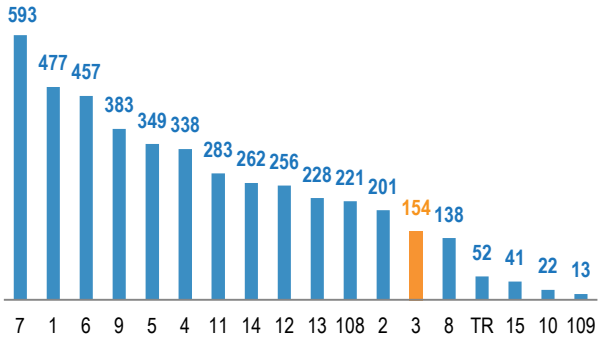
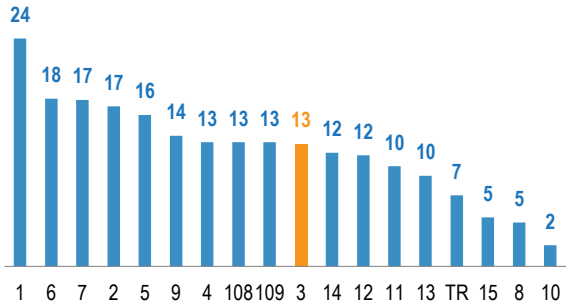


FIGURE 5 – AVERAGE WEEKDAY RIDERSHIP PER TRIP



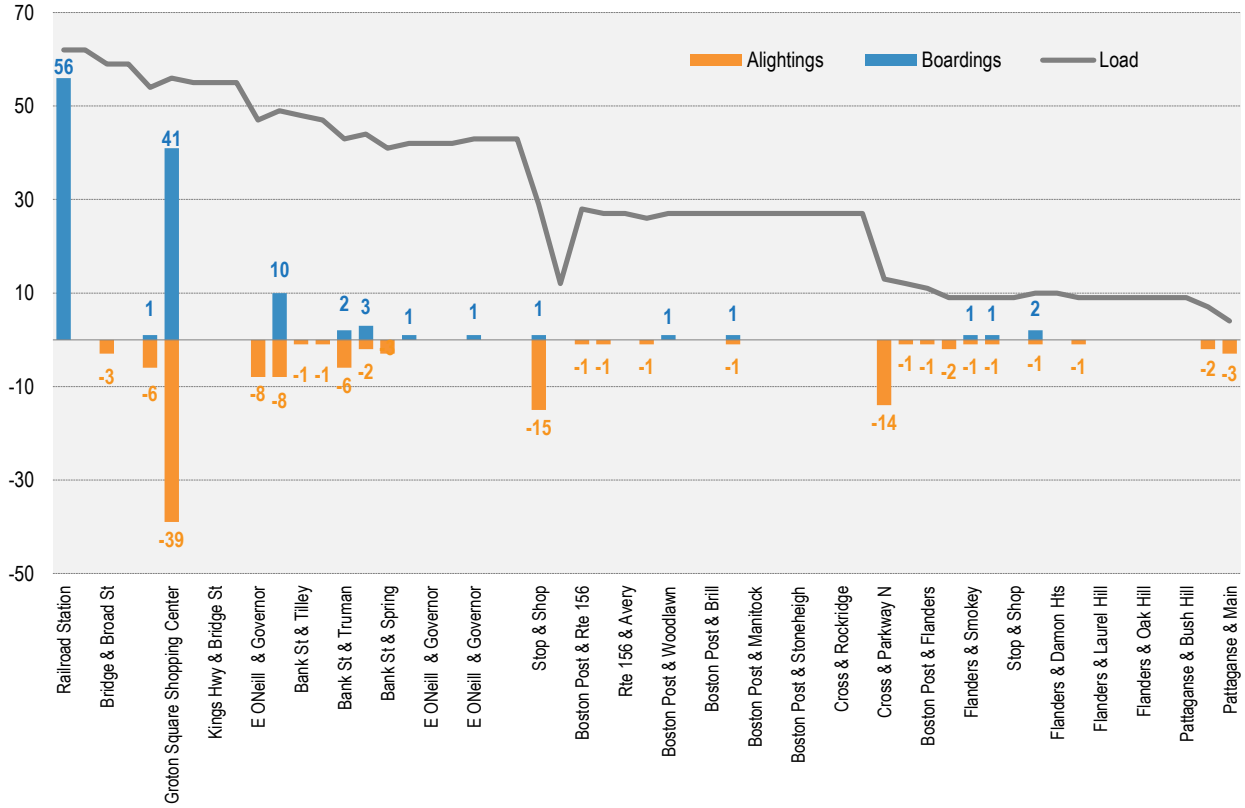
Source: SEAT Ridecheck 2014

Ridership by Stop. Most ridership on Run 3 is focused in New London, with other concentrations of activity located along the run in Waterford and East Lyme. Areas with high concentrations of ridership include:

- **New London Union Station.** Union Station has 56 boardings and 16 alightings.
- **Groton Square Shopping Center.** 41 passengers board Run 3 at Groton Square, and 39 alight.
- **Cross Road & Parkway North.** 10 people board at this stop on eastbound trips.
- **Bank Street.** On average, 7 people per day board Run 3 on westbound trips along Bank Street, while 13 people alight.
- **Stop & Shop.** 6 people board at Stop & Shop on eastbound trips.

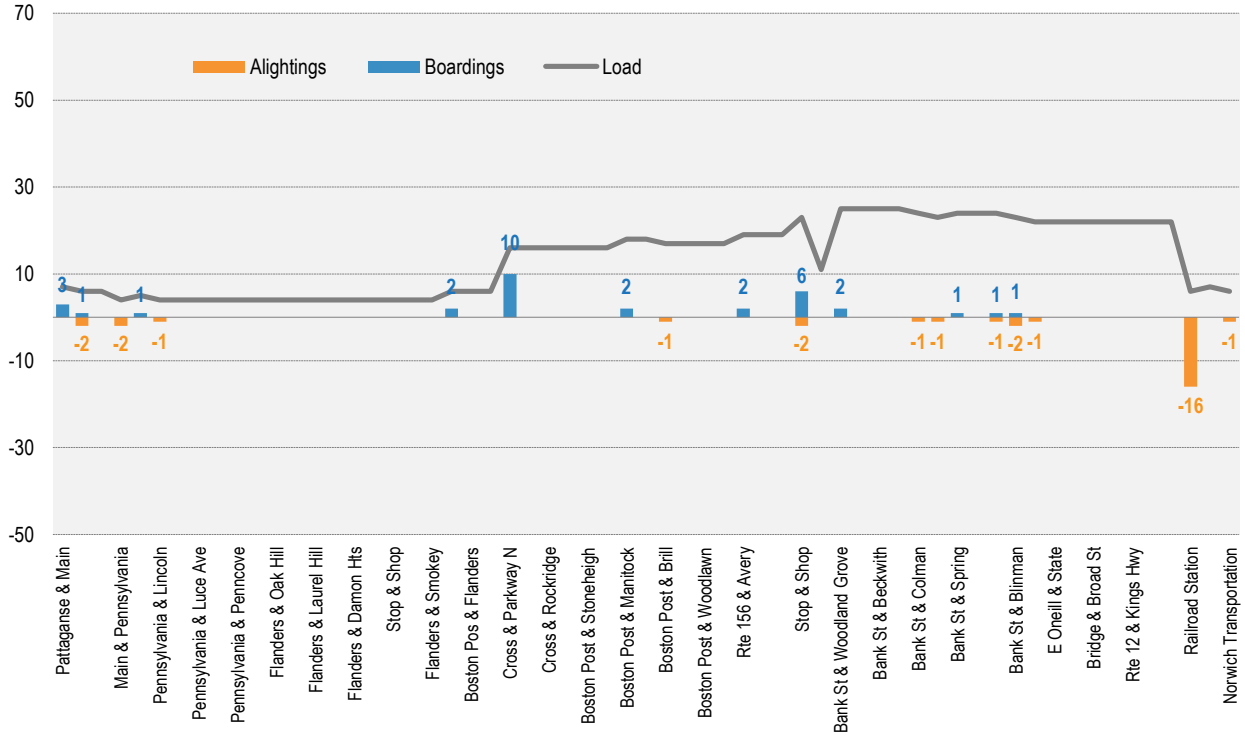
Along the rest of Run 3, ridership is relatively low. There are portions of the run (notably along Flanders Road and in downtown Niantic) that have clusters of ridership, but these do not exceed 1-3 boardings per stop.

FIGURE 6 – WESTBOUND WEEKDAY RIDERSHIP BY STOP CHART



Source: SEAT Ridecheck 2014

FIGURE 7 – EASTBOUND WEEKDAY RIDERSHIP BY STOP CHART



Source: SEAT Ridecheck 2014

FIGURE 8 – WESTBOUND WEEKDAY RIDERSHIP BY STOP MAP

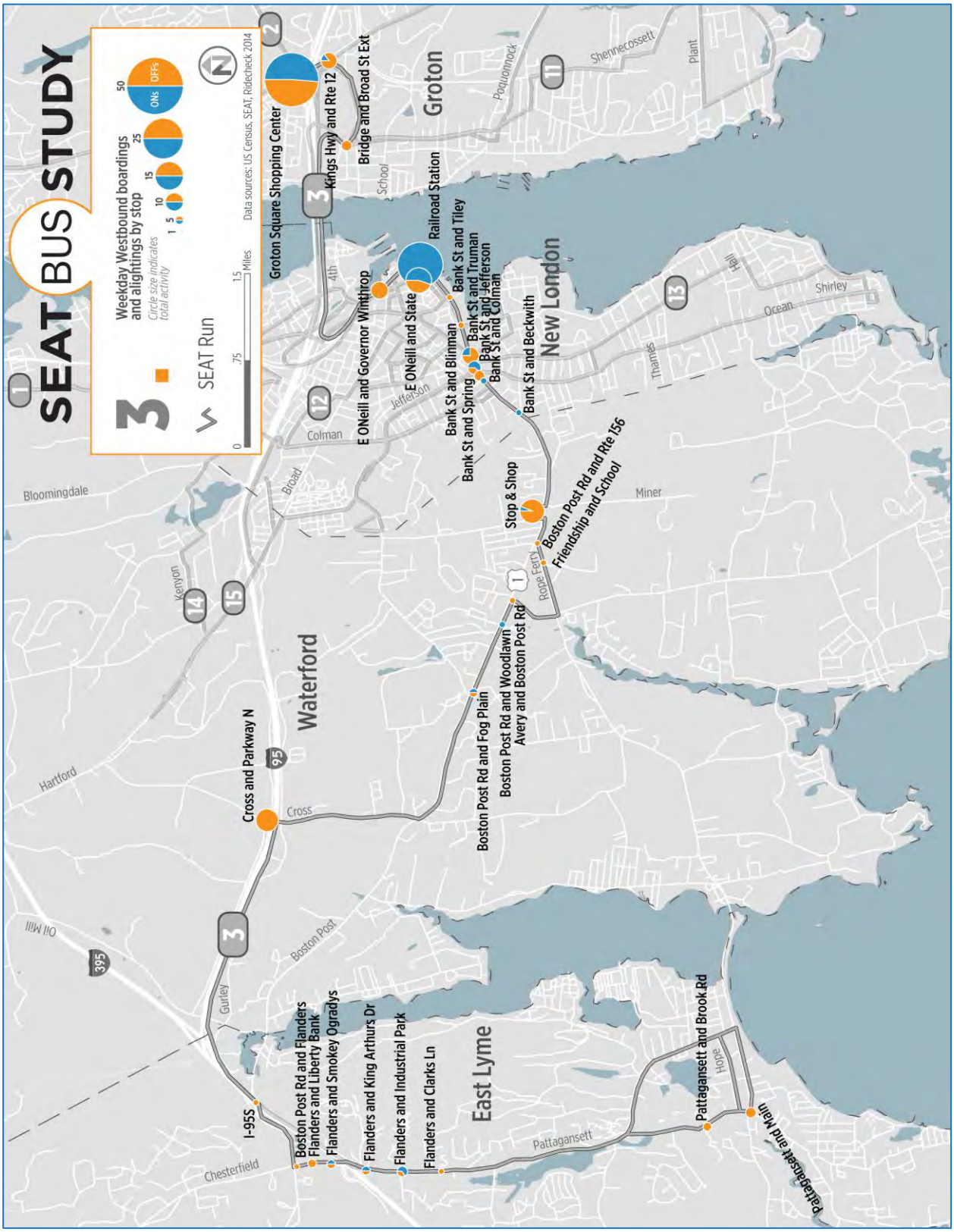
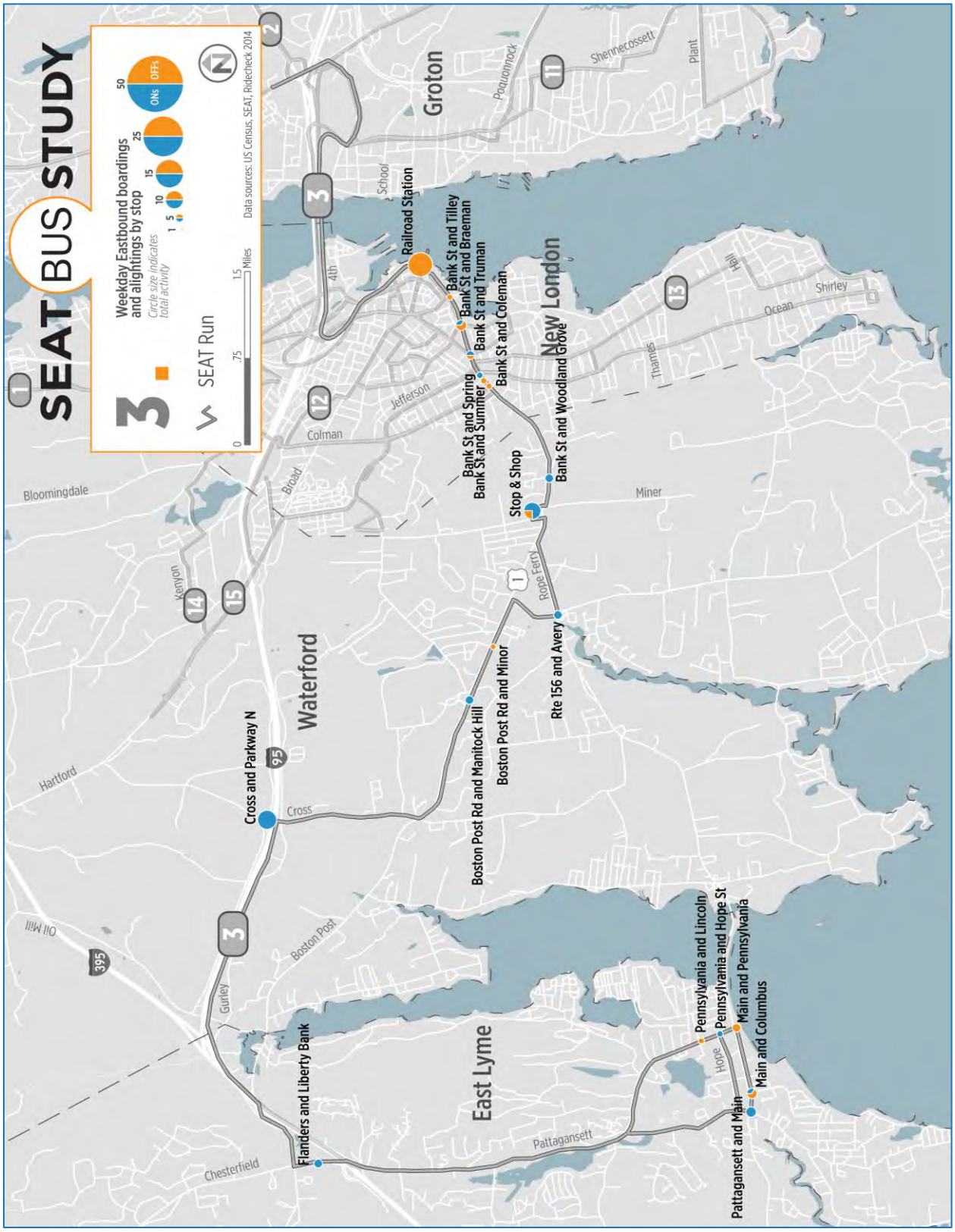


FIGURE 9 – EASTBOUND WEEKDAY RIDERSHIP BY STOP MAP



Ridership by Trip. Run 3 westbound trips experience significantly higher ridership than eastbound trips. More specifically, almost all ridership is on the westbound segment running eastbound between New London and Groton. Ridership peaks on the 11:00 AM outbound trip, which carries an average of 36 passengers – nearly 50% more than the next highest ridership trip (23 passengers at 3:00 PM). The first two outbound trips perform similarly to the 3:00 PM trip.

Eastbound ridership running eastbound from Niantic is significantly lower throughout the day, as average ridership does not exceed 9 passengers per trip. The trips with the highest ridership are the first trip at 8:10 AM and the trip at 2:10 PM. The 10:10 AM trip averages 2 passengers.

The last westbound trip of the day at 5:00 PM carries the fewest passengers on average (7 passengers per trip), but effectively serves as a deadhead trip that follows an alternative alignment from Groton Square northbound along Route 12 towards the Norwich Transit Center. The 5:30 PM "eastbound" trip actually begins at the Ocean State Job Lot along Route 12, and terminates at the Norwich Transportation Center instead of New London.

FIGURE 10 – WESTBOUND WEEKDAY RIDERS PER TRIP

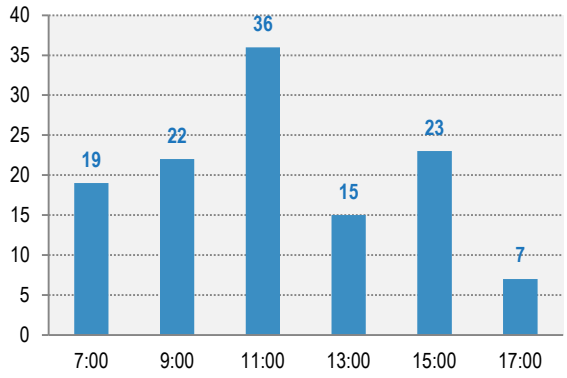
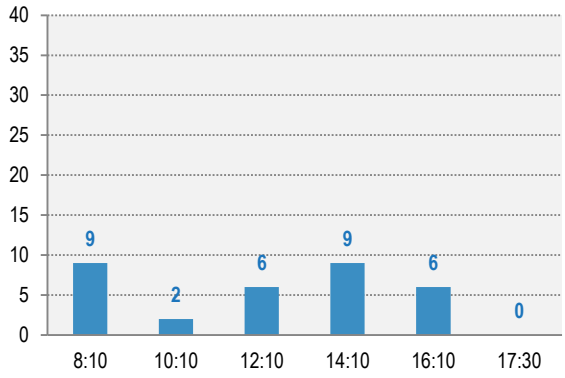


FIGURE 11 – EASTBOUND WEEKDAY RIDERS PER TRIP



Source: SEAT Ridecheck 2014

Performance. Overall, Run 3 performs lower than most SEAT runs (see Figure 12). The run averages 14 passengers per revenue vehicle hour, which is about 70% of the system average and puts Run 3 in the bottom third of SEAT runs on this measure. The run also carries only half the system average in terms of passengers per revenue vehicle mile. Although the average speed for Run 3 is slightly higher than the average for all SEAT runs, its on-time performance is below the system average and above only two other runs in the SEAT system.

FIGURE 12 – PERFORMANCE MEASURES

Performance Measure	Weekday		Saturday		Sunday	
	Run 3	System Avg	Run 3	System Avg	Run 3	System Avg
Passengers per Revenue Vehicle Hour	14.0	20.9	-	16.4	-	12.9
Passengers per Revenue Vehicle Mile	0.8	1.6	-	1.2	-	0.8
Average Speed (mph)	18.6	16.2		15.2		17.6
On-Time Performance Reliability*	44.0%	57.9%	-	52.8%	-	40.8%

*On-Time Performance is the percent of sampled observations where the bus arrived at timepoints within 5 minutes of the scheduled time.
Source: SEAT Analysis Factors 2014

FIGURE 13 – WEEKDAY RIDERS PER REVENUE HOUR

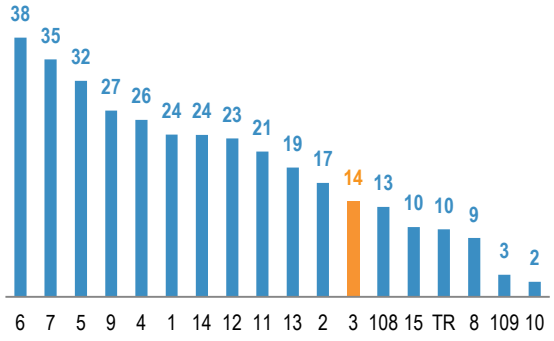
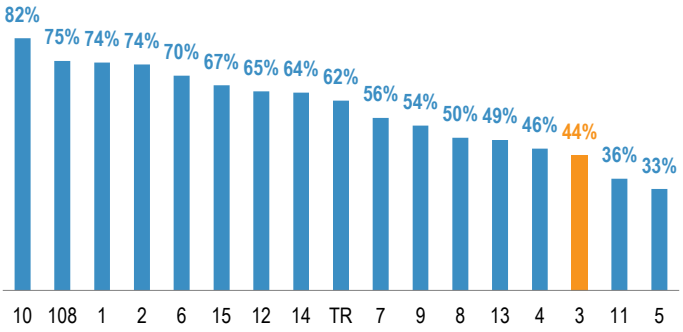


FIGURE 14 – WEEKDAY ON-TIME PERFORMANCE



Source: SEAT Ridecheck 2014

Environmental Justice

Run 3 predominately serves areas with a slightly higher minority population than is found in the SEAT service area overall. About one-quarter (26%) of the population served by Run 3 lives in census blocks that have a minority population greater than the overall service area average (21%). As shown in Figure 16, these minority populations are concentrated in New London and Groton, as well as Waterford Center and Flanders Four Corners in East Lyme.

FIGURE 15 – SERVICE TO BLOCKS WITH HIGH MINORITY POPULATIONS

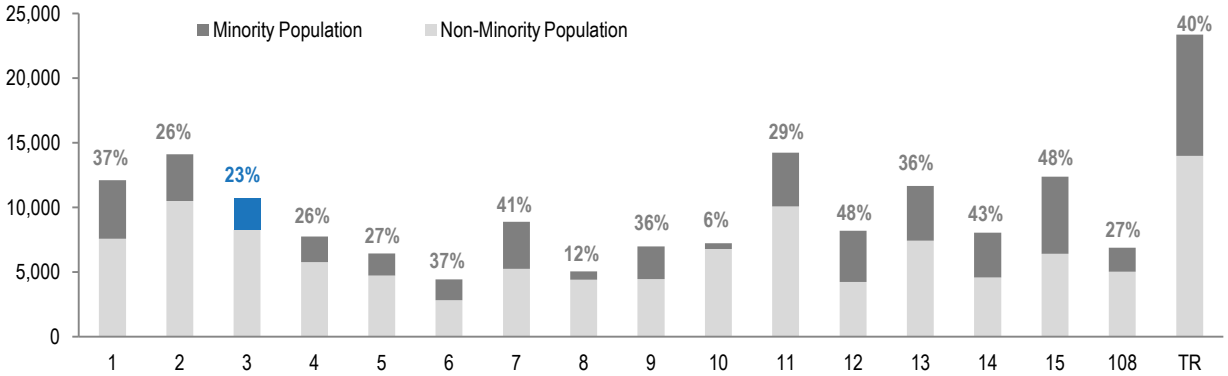
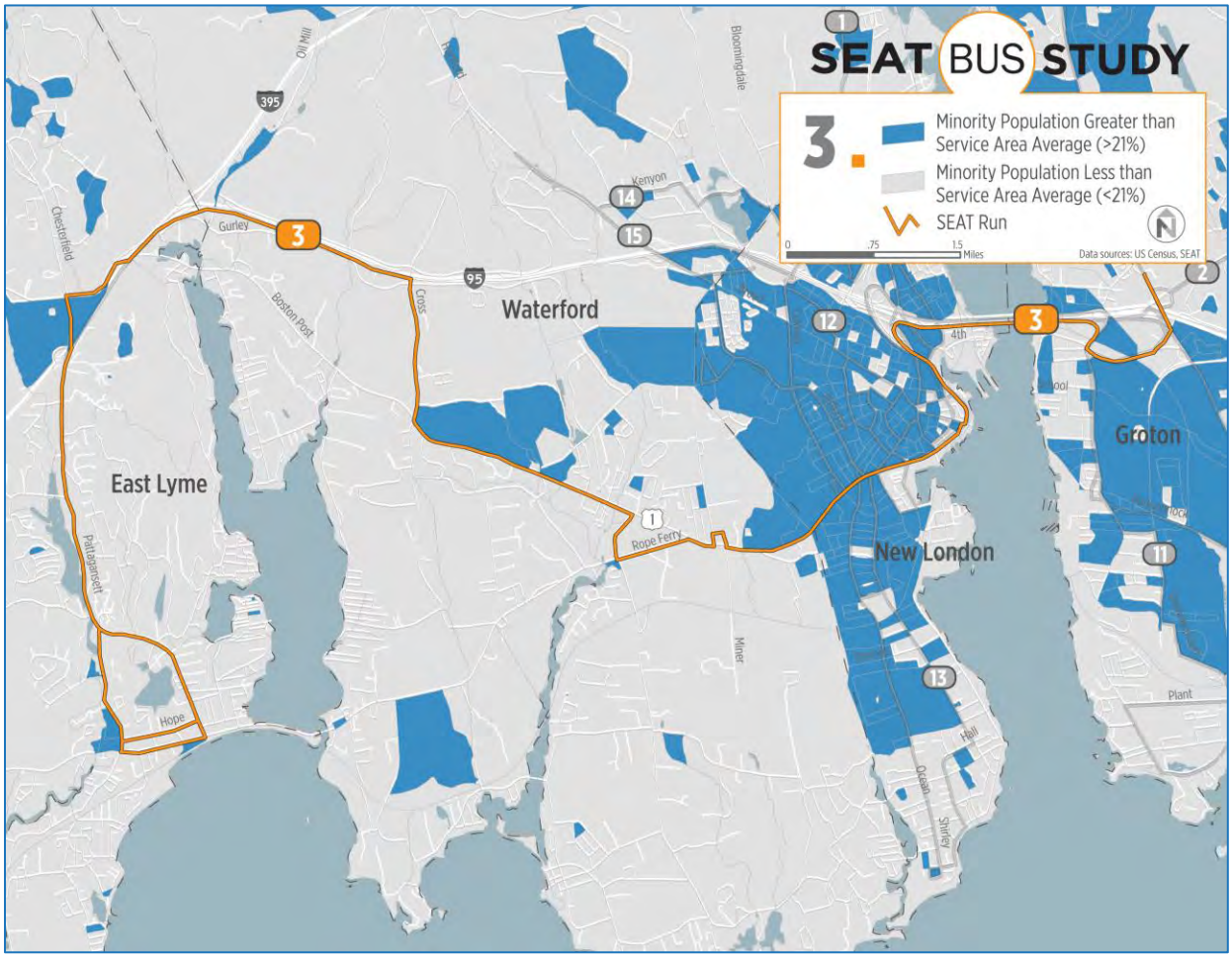


FIGURE 16 – MAP OF BLOCKS WITH HIGH MINORITY POPULATIONS



Source: U.S. Census

SERVICE IMPROVEMENT OPTIONS

Run 3 has lower ridership than most SEAT runs, and is also less productive. The run has one of the lowest on-time performance rates in the system, although recent schedule adjustments by SEAT may help alleviate this.

In some ways, the run performs as two independent runs, connecting Groton to New London, and connecting Niantic and Waterford to New London. The highest ridership generators are the New London Union Station (SEAT's bus hub) and Groton Square. Ridership is also fairly strong along Bank Street, and at Stop & Shop on Boston Post Road and the Wal-Mart/Lowes shopping center at Cross and Parkway North. Ridership is generally very low along Boston Post Road and Cross Road, and in East Lyme.

The following opportunities could be considered to improve Run 3's overall efficiency and better match service with demand.

- **Operate service as two separate runs/Increase New London to Groton frequency:** Most of the current ridership on Run 3 is between Groton Square and New London, and this portion of the alignment would benefit from higher frequency service. This

service could be coordinated with other New London to Groton connections (Runs 2 and 108) to provide frequent consistent connections.

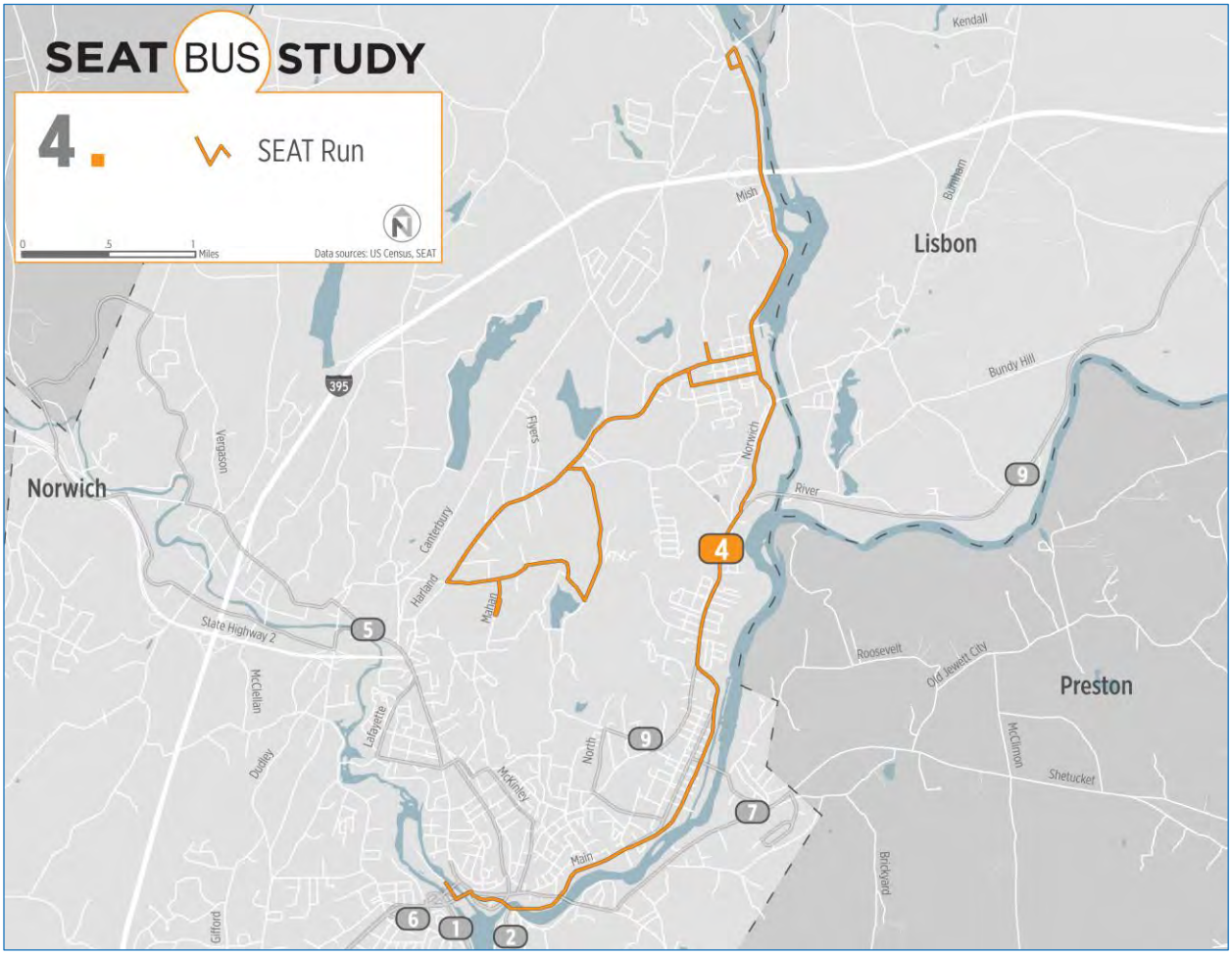
- **Discontinue Run 3 service to Groton.** See above. Connections between New London and Groton warrant more frequent service, yet this segment of Run 3 is duplicated by other SEAT runs (2 and 108). Discontinuation of Run 3's service to Groton would allow resources to be redirected to an alternate run, or a new dedicated service.
- **Offer Saturday service between New London & Groton:** If Run 3 were to be separated into two run segments, the New London to Groton service could be operated on Saturday.
- **Remove deviation to AHEPA Housing.** According to ridership data, there are no boardings or alightings at the AHEPA Housing stop in Waterford. Removing the two daily trips to this stop would reduce travel times for riders traveling westbound on Boston Post Road, and may attract additional riders to Run 3.
- **Discontinue service west of Cross Road.** Run 3 carries very few riders west of Cross Road and this unproductive segment of the run could be discontinued.
- **Discontinue service south of Four Corners seasonally.** Run 3 service in Niantic is likely seasonal, with higher ridership during the summer and very low ridership the rest of the year. Service south of Four Corners (where US-1 meets I-95) could be operated during the summer only and discontinued during the off seasons.
- **Convert Run 3 to demand response service.** Run 3 is an unproductive service and its low ridership may not justify fixed-route transit service. Run 3 could be discontinued and service in Niantic could be replaced by a demand response service that would offer limited on-demand service throughout Niantic.
- **Operate express service or limited stop service between Niantic and New London.** Another option to consider is redesigning Run 3 to provide express service between Niantic and New London.
  - Operating limited stop service along Route 161, Boston Post Road and Bank Street could reduce the one-way trip time to less than 30 minutes. This would provide a much higher level of service for Niantic and provide fast service to transfer opportunities at New London.
  - Operating express from Flanders Corner to Cross Road and into New London via I-95 would further increase speeds. Replacement service along Boston Post Road into Waterford Center could be provided through realignment of another New London run.
- **Extend to Correctional Institute and Rocky Neck State Park:** Given relatively high boardings at the correctional facility located on Route 32 in Montville, an extension from Niantic to the York Correctional Facility by Rocky Neck State Park could be considered. This would give employees of the facility the opportunity to take transit to and from work.
- **Identify last eastbound/westbound trips as Run 2.** The last eastbound and westbound trips of the day operate on a different alignment that is more closely associated with Run 2. These trips travel along Route 12, terminating at the Norwich Transportation Center, and would be more easily identified by riders if included on Run 2 schedules.
- **Discontinue Run 3.** Given the run's low ridership and productivity compared to other SEAT runs, one option to consider is discontinuing Run 3 service and reallocating SEAT resources to serve areas with higher demand.

SERVICE EVALUATION

RUN 4 (TAFTVILLE / OCCUM / GREENVILLE)

Service Design. Run 4 is a coverage-focused run, operating between Norwich and Taftville and Occum, operating fairly direct in the northbound direction but with a large loop deviation on the southbound trip. The run begins at Norwich Transportation Center, proceeds north on West Main, east on Chelsea Harbor Drive in downtown Norwich, and then north again on North Main Street. North Main Street continues as Boswell Avenue, Norwich Avenue, and Taftville-Occum Road. The bus turns around in Occum, returning southbound via Taftville-Occum Road. The run then deviates in Taftville on South B Street, northbound on Hunters Avenue, southwest on Providence Street/Merchants Avenue, then westbound on Hunters Road, Harland Road and Ox Hill Road to serve Norwich Tech and Rose City Senior Center. The run returns via Mohegan Park Road, completing a large loop before proceeding north again on Harland Road, Merchants Avenue/Providence Street. Once returning to Taftville, the run operates southbound on Norwich Avenue, Central Avenue, and North Main Street to return to Norwich Transportation Center.

FIGURE 1 - RUN MAP



Service Schedule. Run 4 has a fairly complex service pattern, given the number of deviations in its service. Service operates every hour from 6:00 AM to 6:00 PM on weekdays, and from 7:00 AM to 6:00 PM on Saturdays. The schedule suggests that service alternates between Occum and the Rose City Senior Center. The ride-check data, however, indicates that some trips serve both Occum and the Senior Center on the same trips. A clarification and update of the schedules are needed.

FIGURE 2 – SCHEDULE STATISTICS

Service Day	Span of Service	Frequency (min) Peak / Off-Peak	Daily Trips
Weekday	6:00 AM — 6:00 PM	60	13
Saturday	7:00 AM — 6:00 PM	60	12
Sunday	-	-	-

Source: SEAT Run Schedules

Interaction with System. Run 4 originates and terminates at the Norwich Transportation Center, which is a major transfer point with other local and regional destinations within the SEAT network. In addition, Run 4 interacts with the following runs:

- Run 9 serves similar areas as Run 4. Between Hickory Street and Norwich Transportation, southbound Run 9 operates on the same alignment as Run 4 on North Main Street. In addition, between North Main Street at Boswell Avenue and River Road the two lines parallel each other. Finally, Run 9 operates on Boswell Avenue, which in some parts of the Greenville neighborhood is in close proximity to Run 4's alignment on Central Avenue and North Main Street.
- Run 7 operates southbound service in the evenings on Central Avenue and North Main Street between the 8th Street Bridge and Norwich Transportation Center, providing evening coverage for Run 4.

Ridership by Service Day. Run 4 is the sixth highest average weekday ridership run in the system, with 338 daily passengers, and averages 13 passengers for every roundtrip, which is exactly the SEAT weekday average (see Figures 3 through 5). On Saturdays, 207 people use the service, averaging 17.3 for every roundtrip, about twice the SEAT Saturday average.

FIGURE 3 – RIDERSHIP STATISTICS

Service Day	Daily Ridership	Ridership per Trip	
	Run 4	**Run 4**	**System Avg**
Weekday	338	13.0	13.0
Saturday	207	17.3	9.5
Sunday	-	-	5.8

Source: SEAT Ridecheck 2014

FIGURE 4 – AVERAGE WEEKDAY RIDERSHIP

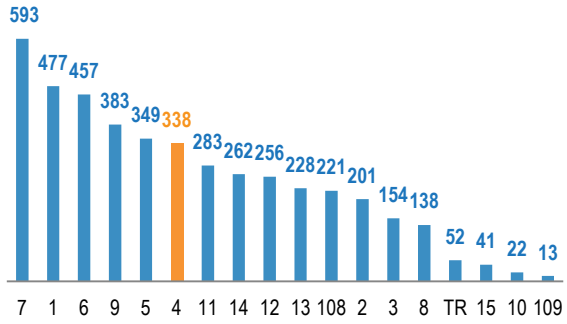
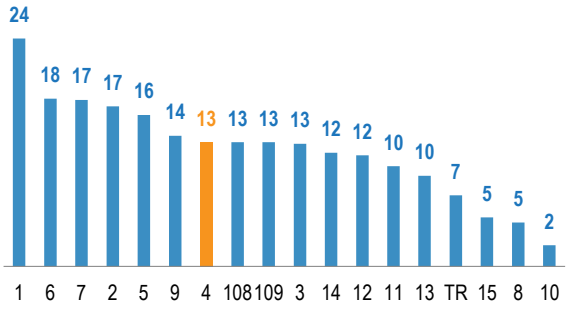


FIGURE 5 – AVERAGE WEEKDAY RIDERSHIP PER TRIP



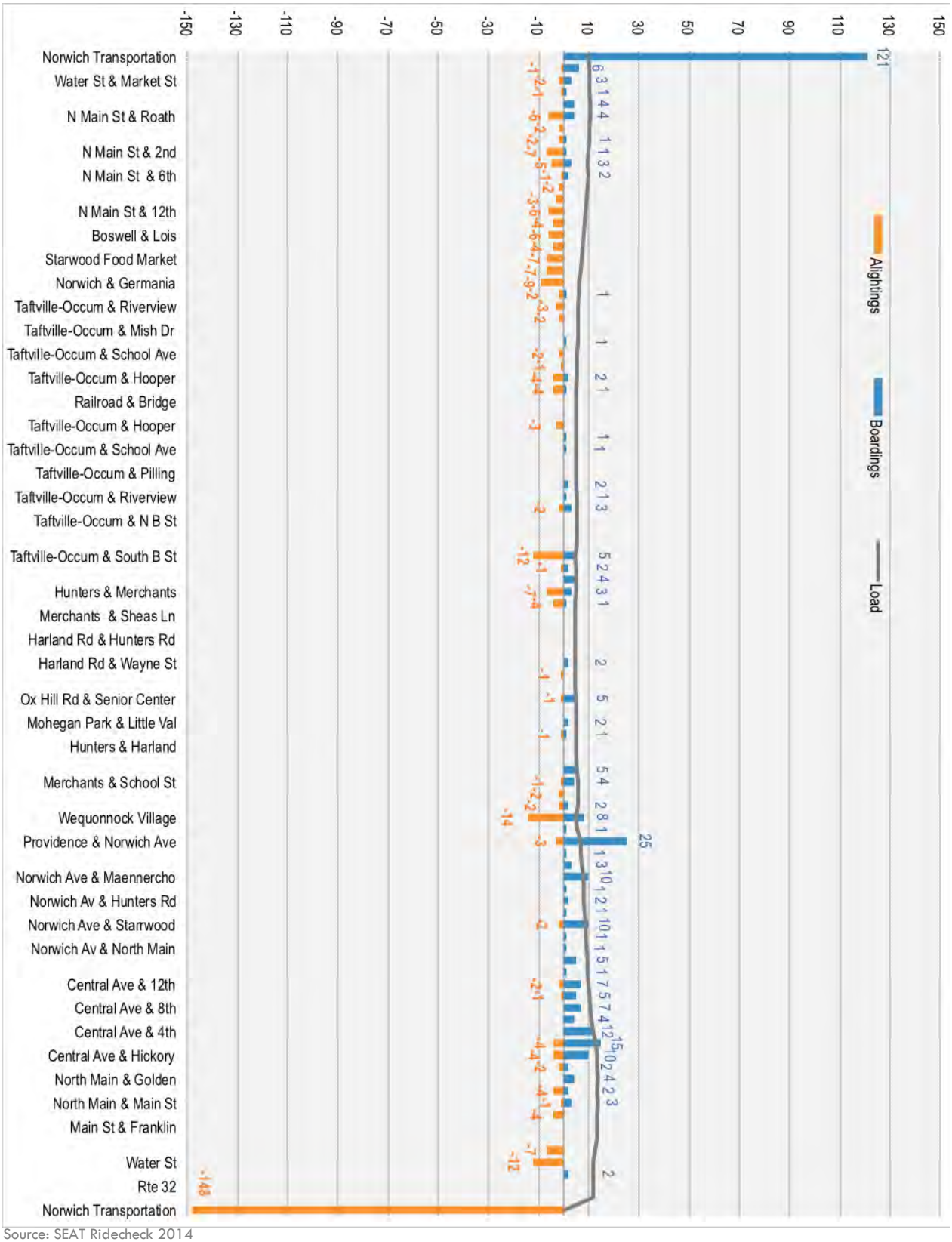
Source: SEAT Ridecheck 2014

Ridership by Stop. Ridership activity on Run 4 is overwhelming oriented toward the Norwich Transportation Center (see Figure 6 and 7). This indicates that a large number of Run 4 riders are using the service for travel to/from the transit center, likely transferring to other SEAT runs. Outside of the transit center, ridership is generally distributed along the service area. Areas with high concentrations of ridership include:

- **Norwich Transportation Center** is the highest ridership stop with 121 daily boardings and 148 daily alightings.
- **Providence Street at Norwich Avenue** (southbound) in Taftville is the second highest ridership stop on the run with 25 boardings and 3 alightings. This in the central part of Taftville where several businesses are located.
- **Wequonnoc Village** (southbound) on North Fifth Street in Taftville has 8 boardings and 14 alightings. This is an affordable housing complex and would most likely have higher proportion of transit dependent residents.
- **Taftville–Occum and South B Street** (northbound) has 12 alightings and five boardings. This stop is served before the run takes the long deviation to the Rose City Senior Center/Norwich Tech High School
- **Central Avenue** (southbound) in Greenville has fairly high combined ridership. Between 12th Street and Hickory Street, there is a total of 60 boardings and 11 alightings across all stops.
- **Norwich Avenue at Maennerchor Avenue** and the **Starrwood Food Market** (southbound) in Taftville both have ten boardings each, the latter also has 2 alightings. Maennerchor Avenue also serves the Bob's Discount Furniture Distribution Center.

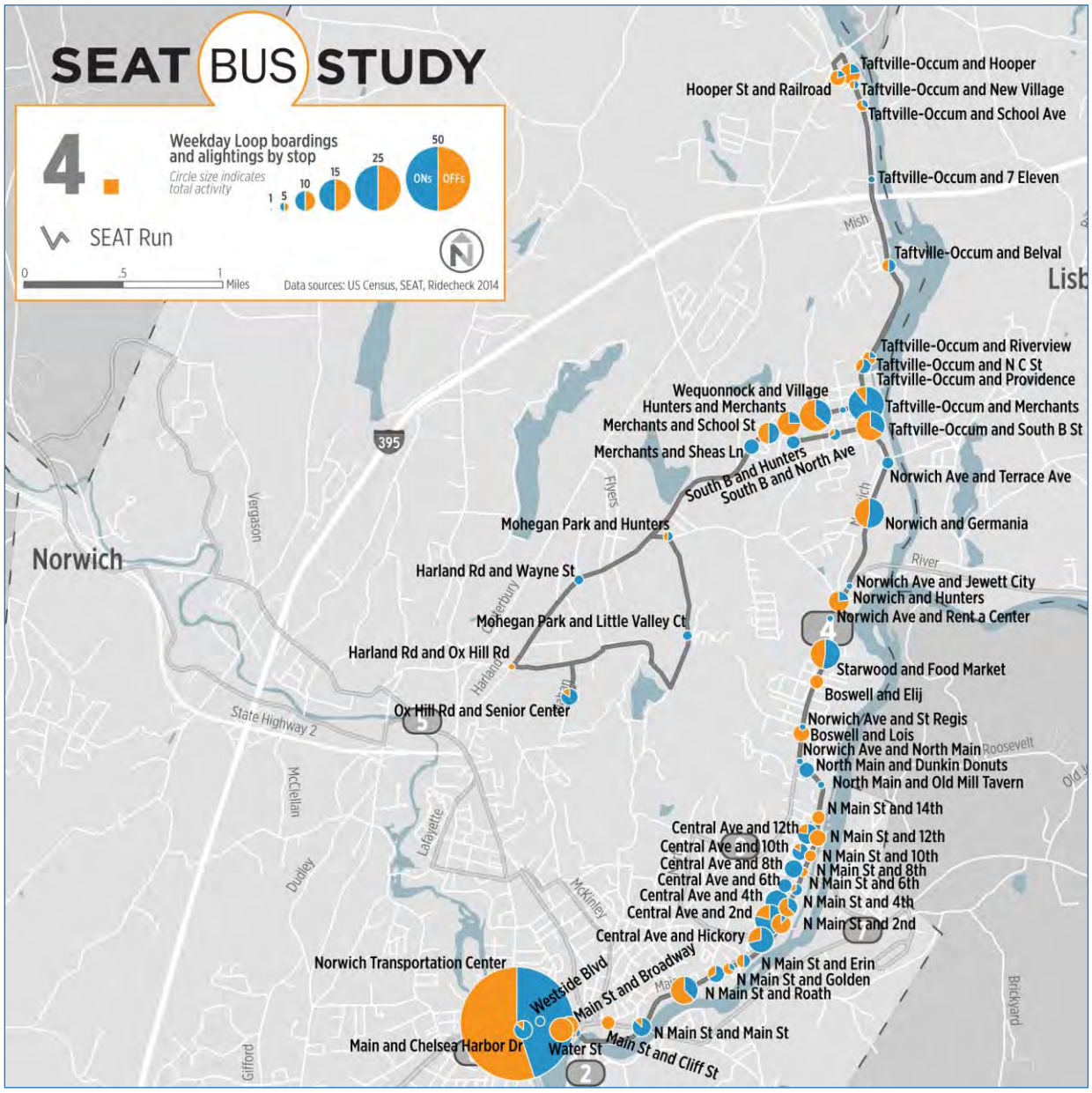
Ridership data suggests that there are passengers who ride through the line when it switches directions at Occum, implying that there may be some confusion over the run's schedule or alignment. Additionally, people may be riding around the loop in order to access destinations that are only served in one direction.

FIGURE 6 – ROUNDTRIP LOOP WEEKDAY RIDERSHIP BY STOP CHART



Source: SEAT Ridecheck 2014

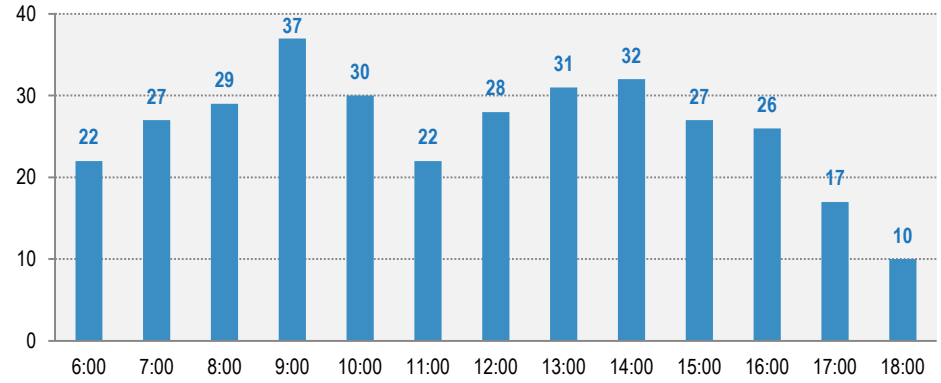
FIGURE 7 – ROUNDTRIP LOOP WEEKDAY RIDERSHIP BY STOP MAP



Source: SEAT Ridecheck 2014

Ridership by Trip. Although Run 4 ridership is highest in the late morning and in the early afternoon, ridership patterns do not coincide with the traditional peak commute hours. Ridership begins in the morning with 22 riders on the roundtrip, increases to 37 on the 9:00 AM trip, and then declines to 22 on the 11:00 AM trip. Ridership increases again until 2:00 PM with 32 passengers, before declining again. The last 6:00 PM trip is the lowest ridership trip with 10 total passengers.

FIGURE 8 – LOOP WEEKDAY PASSENGERS PER ROUNDTRIP



Source: SEAT Ridecheck 2014

Performance. Run 4 is a productive run that generally performs above the SEAT average (see Figures 9 and 10). The run carries 26.0 passengers per revenue hour, which is above the system average of 20.9. Saturday service is likewise more productive than the system average with 17.3 riders per hour compared to 16.4 systemwide. Operational speed and on time reliability, however, are below the network average. Run 4's average speed is 15.4 miles per hour on weekdays and Saturdays, and on-time performance is 46.2% on weekdays and 33.3% on Saturdays (see Figure 11). Reducing the number of turns and reducing the run time would help improve operational reliability.

FIGURE 9 – PERFORMANCE MEASURES

Performance Measure	Weekday		Saturday		Sunday	
	Run 4	System Avg	Run 4	System Avg	Run 4	System Avg
Passengers per Revenue Vehicle Hour	26.0	20.9	17.3	16.4	-	12.9
Passengers per Revenue Vehicle Mile	1.7	1.6	1.1	1.2	-	0.8
Average Speed (mph)	15.4	16.2	15.4	15.2		17.6
On-Time Performance Reliability*	46.2%	57.9%	33.3%	52.8%	-	40.8%

*On-Time Performance is the percent of sampled observations where the bus arrived at timepoints within 5 minutes of the scheduled time.
Source: SEAT Analysis Factors 2014

FIGURE 10 – WEEKDAY RIDERS PER REVENUE HOUR

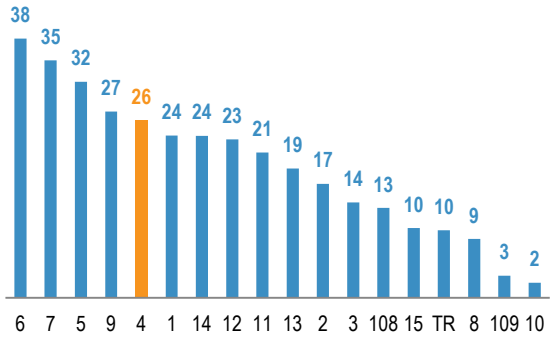
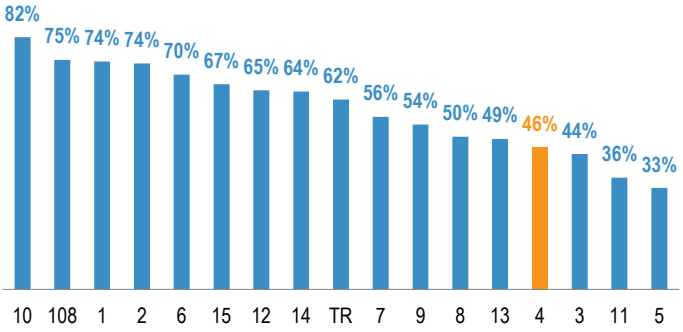


FIGURE 11 – WEEKDAY ON-TIME PERFORMANCE

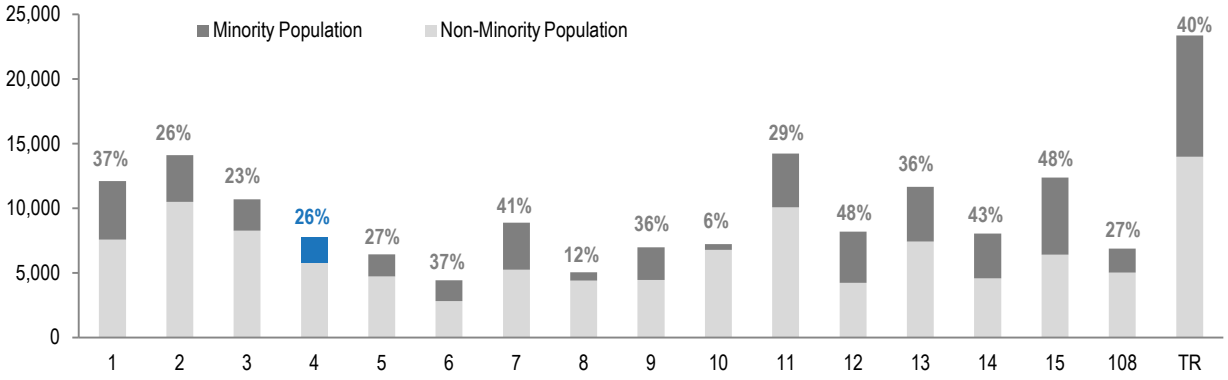


Source: SEAT Ridecheck 2014

Environmental Justice

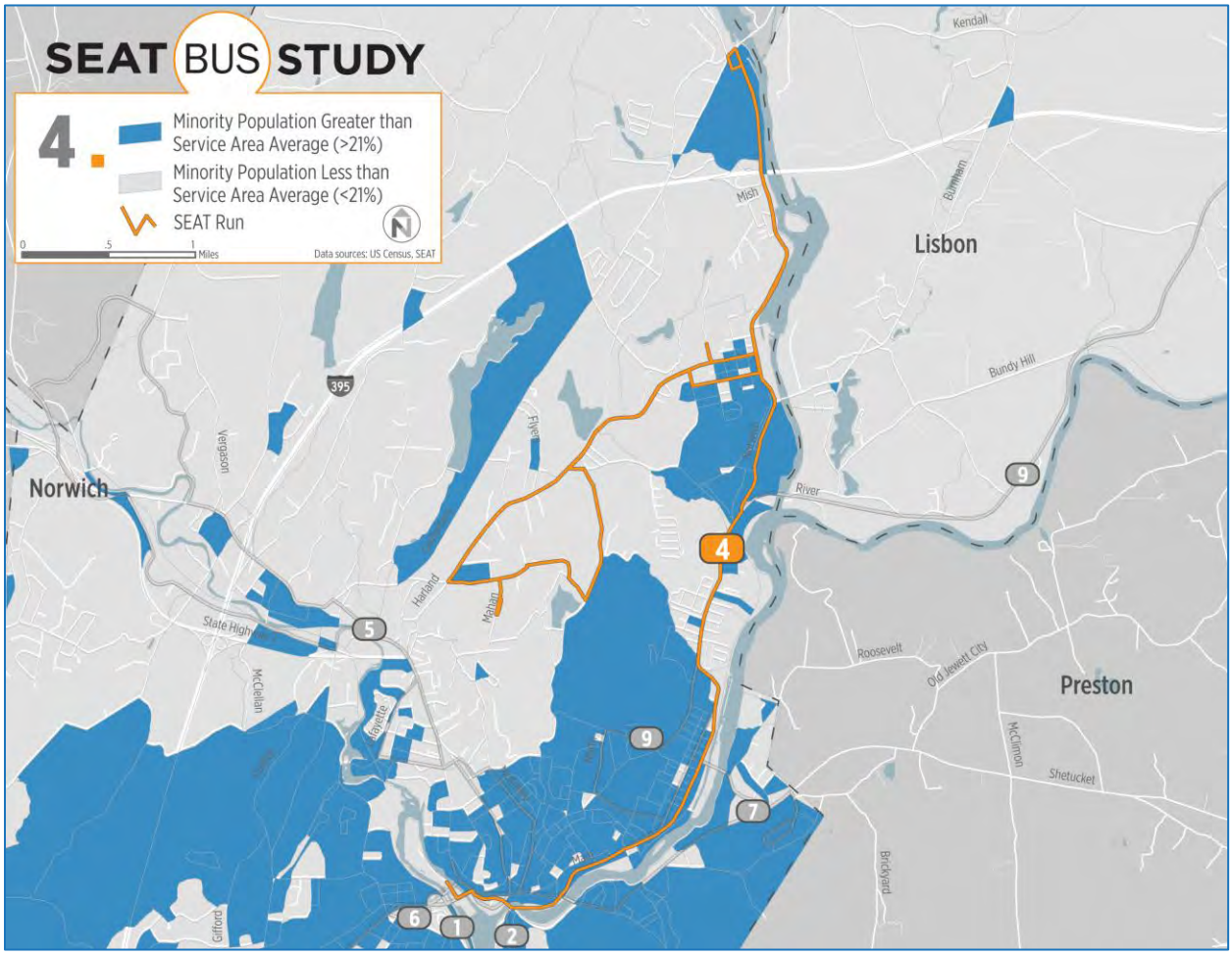
Most Census blocks in the central parts of Norwich have a higher percentage of minority residents compared to the region as a whole. Consequently, for most of the Run 4's alignment, there are high percentages of minority population, primarily in Norwich, Taftville, as well as Occum. The deviation to serve Rose City Senior Center and Norwich Tech High School, however, has a lower percentage of minority residents compared to the region as a whole. In total, the 26% of the Census blocks the run serves have higher percentages of minority populations.

FIGURE 12 – SERVICE TO BLOCKS WITH HIGH MINORITY POPULATIONS



Sources: US Census 2010, SEAT

FIGURE 13 – MAP OF BLOCKS WITH HIGH MINORITY POPULATIONS



Sources: US Census 2010, SEAT

SERVICE IMPROVEMENT OPTIONS

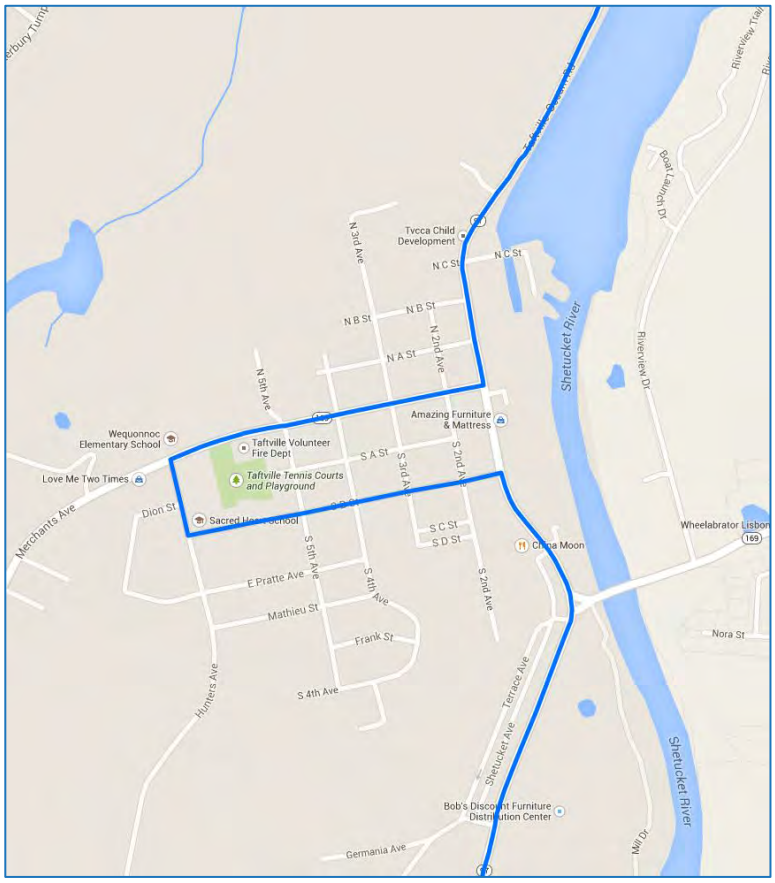
Run 4 is relatively productive and provides geographic coverage to large areas of Norwich. However, the run has a complicated service pattern, with a large deviation loop in one direction of service. The deviation to serve the Rose City Senior Center and Norwich Tech High School adds significant travel time to the run and forces the majority of passengers to sit through the loop. Consequently, ridership north of Taftville is fairly low in comparison to the rest of the run. Finding a way to avoid such a major deviation on Run 4 is thus a major part of the following service options:

- **Discontinue the Taftville deviation.** The run currently deviates nearly 6 miles to serve the Rose City Senior Center and Norwich Technical High School, but there are very few riders at these institutions. While the senior center and high school are important regional institutions, they are geographically isolated and very difficult to serve effectively. Additionally other stops on the deviation serve very few daily passengers, except for the Hunters Avenue at Merchants Avenue stop, which has 7 alightings and 3 boardings. The latter stop is located 0.4 miles (8 minute walk) from the Taftville-Occum Road, and thus would still be accessible if the alignment were straightened. However, the straightened service would benefit far more riders than the number of people using the deviation. Finally, there are already transportation services provided by the Rose City Senior Center with advanced reservations. Eliminating the deviation and making the service

faster and more direct would also greatly improve service for riders in Occum, as they would no longer have to sit through the long deviation.

- **Shorten the Taftville deviation.** The long 6-mile deviation in Taftville could be shortened to speed service through the area but also maintain service to most of the Taftville riders. While a shortened deviation would probably not serve the Rose City Senior Center and the Norwich Technical High School, it could maintain direct service to 75% of the deviation's ridership if routed as the example in Figure 14 shows. In addition, the shortened deviation could be served in both directions of service, which would benefit the residents of Taftville, as they have would have options for travel in both directions and could make faster round trips.

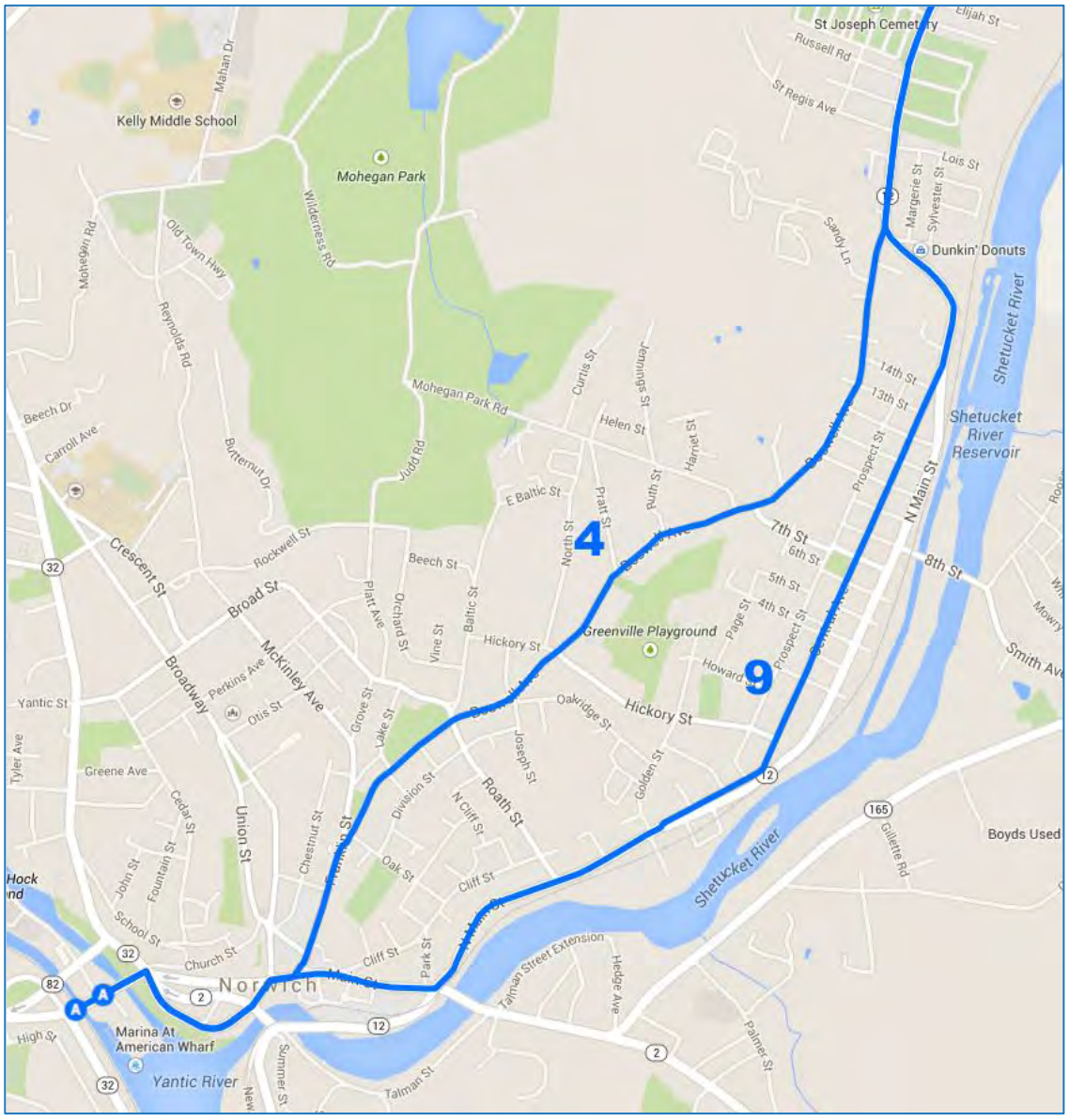
FIGURE 14 – EXAMPLE SHORTENED DEVIATION



- **Serve Rose City Senior Center/Norwich Tech with another run.** Rose City Senior Center is an important social institution, however it is extremely geographically isolated and nearly impossible to serve efficiently. If serving the Rose City Senior Center is necessary, it may be more efficient to serve with another run that operates in closer proximity to these two points.
- **Coordinate Rose City Senior Center van services with SEAT bus schedules.** Rose City Senior Center provides van transportation for members of the senior center. Coordinating a van service pick-up to meet SEAT service at a convenient location would avoid the need for SEAT to deviate so far in order to provide service to the senior center.
- **Update Schedule Cards and Maps.** The current schedule fails to adequately describe any variations in run patterns. Additionally, the ridecheck data suggests that the alignments and scheduling are different than what is published on SEAT's website. Updating and producing an easy-to-follow schedule would reduce any confusion about the line.

- **Operate both directions on Central Avenue.** Having both directions operate on a single street allows for more consistent, easy-to-remember service. Central Avenue would provide a larger catchment area compared to North Main Street, which borders the Shetucket River.
- **Realign Norwich service to Boswell Avenue.** Run 4 currently provides service along North Main Street in Norwich, which duplicates service provided by Run 9. Both runs could be realigned to serve distinct and unique markets. For example, Run 4 could be realigned to serve Franklin Street and Boswell Avenue through Norwich, and Run 9 could be realigned to serve Central Avenue only. Such a realignment would give each run a unique market that would better spread service through downtown Norwich (see Figure 15).

FIGURE 15 – EXAMPLE REALIGNMENT OF RUNS 4 AND 9 THROUGH NORWICH

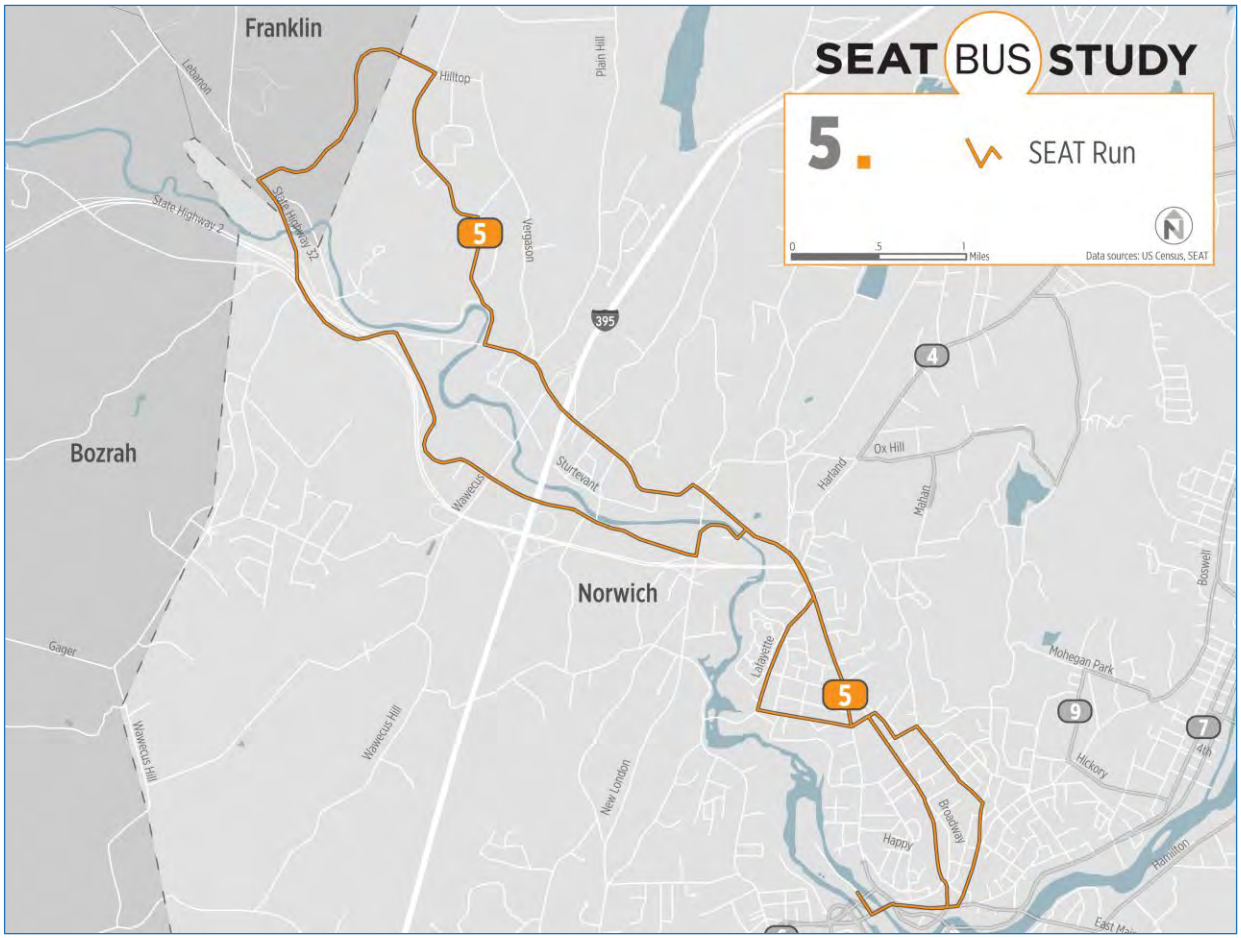


SERVICE EVALUATION

RUN 5 (INDUSTRIAL PARK / NORWICHTOWN / BACKUS HOSPITAL)

Service Design. Run 5 provides service between Norwich Transportation Center and the northwestern portion of Norwich, including Norwich Business Park, Norwichtown Commons shopping center, and Backus Hospital. The run operates one-way service only along most of the alignment. Northbound trips begin at Norwich Transportation Center and travel east on Chelsea Harbor Drive and north on Franklin Street and McKinley Street. Run 5 travels north and west along several streets briefly, including Rockwell, Crescent, Sachem, and Lafayette, before continuing northwest along Town Street. The run continues along Connecticut Avenue and Wisconsin Avenue, through the Norwich Business Park, then turns west and briefly travels into the Town of Franklin along New Park Avenue before turning back south onto Franklin Turnpike (Route 32). Buses continue southeast along Franklin Turnpike, Otrobando Avenue, and back onto West Town Street, stopping at Norwichtown Commons and Backus Hospital. Buses continue traveling south on Washington Street before turning west on Main Street and returning to the Norwich Transportation Center.

FIGURE 1 - RUN MAP



Service Schedule. Run 5 operates hourly service six days a week (weekdays and Saturdays). The run departs Norwich Transportation Center every hour on the hour beginning at 8:00 AM on weekdays, with the last round trip departing at 6:00 PM. On Saturdays, service begins at 9:00 AM and the last round trip begins at 5:22 PM. Run 5 operates 22 round trips per day on weekdays and 18 round trips on Saturdays.

FIGURE 2 - SCHEDULE STATISTICS

Service Day	Span of Service	Frequency (min) Peak / Off-Peak	Daily Trips
Weekday	8:00 AM — 6:22 PM	60	22
Saturday	9:00 AM — 5:22 PM	60	18
Sunday	-	-	-

Source: SEAT Run Schedules

Interaction with System. Run 5's alignment does not overlap with any other SEAT run, although passengers can connect with SEAT runs 1, 2, 4, 6, 7, and 9 at Norwich Transportation Center.

Ridership by Service Day. Run 5 is quite productive compared to other SEAT runs (see Figure 3). Ridership on Run 5 averages 349 riders per weekday, which is well above the system average and behind only four other runs. Ridership per trip averages 15.9 riders, above the SEAT system average of 13.0 riders. Run 5 is not quite as strong on Saturdays, with an average of 171 riders per day and 10.7 riders per trip, though still slightly above average.

FIGURE 3 – RIDERSHIP STATISTICS

Service Day	Daily Ridership	Ridership per Trip	
	Run 5	**Run 5**	**System Avg**
Weekday	349	15.9	13.0
Saturday	171	10.7	9.5
Sunday	-	-	5.8

Source: SEAT Ridecheck 2014

FIGURE 4 – AVERAGE WEEKDAY RIDERSHIP

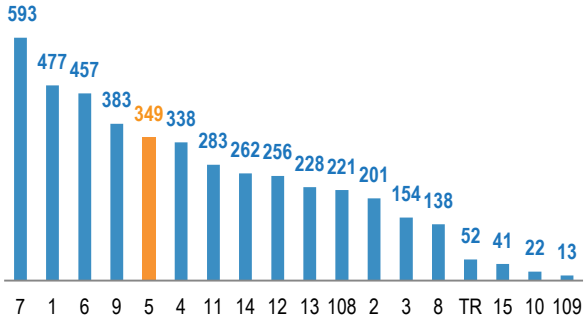
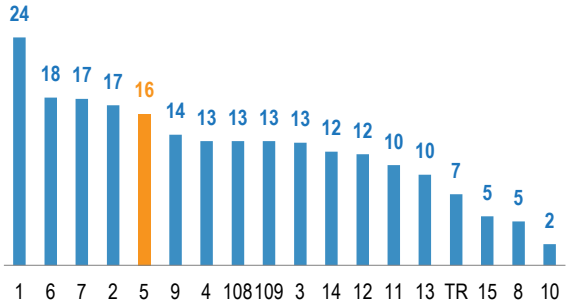


FIGURE 5 – AVERAGE WEEKDAY RIDERSHIP PER TRIP



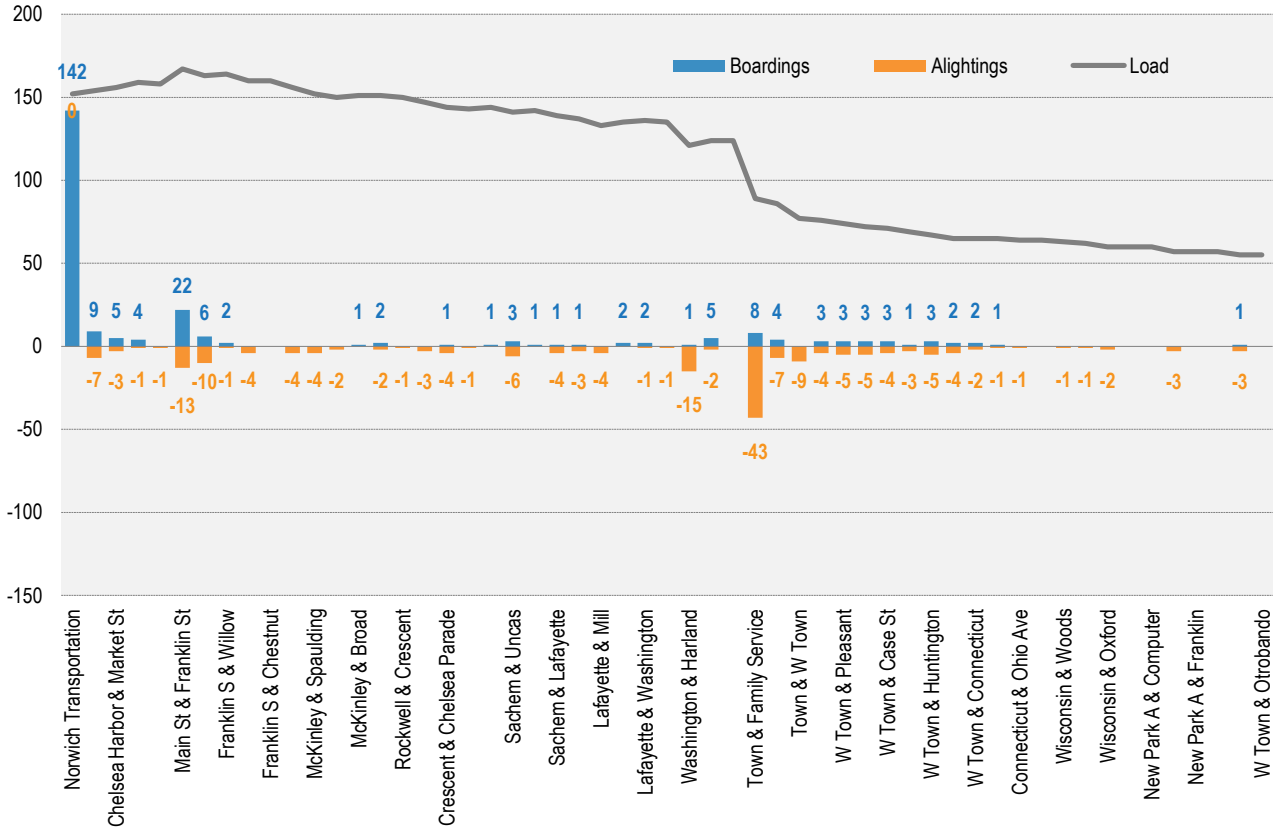
Source: SEAT Ridecheck 2014

Ridership by Stop. Run 5 is heavily oriented toward the Norwich Transportation Center, evidenced by the high ridership at this stop compared with other areas along the run. Areas with high concentrations of ridership include:

- **Norwich Transportation Center.** 142 passengers board Run 5 at the Norwich Transportation Center, and 123 passengers alight here.
- **Main Street & Franklin Street.** This location in downtown Norwich has 22 boardings and 13 alightings, and is central to a cluster of downtown businesses.
- **Norwichtown Commons.** 29 people board at Norwichtown Mall Shopping Center (Stop & Shop) on southbound trips, and 8 board on northbound trips.
- **West Town Street.** This segment of Run 5 has a relatively high level of rider activity. An average of 36 people board Run 5 along Town Street and West Town Street between Norwichtown Commons and Connecticut Avenue.
- **Backus Hospital.** The hospital is served by activity in several areas, including at Lafayette, Bliss Street, and Harland Street. Collectively, the hospital generates 11 boardings and 17 alightings.
- **Broadway.** Along Broadway between Elmwood Street and Main Street, an average of 28 people per day board Run 5 toward Norwich Transportation Center.

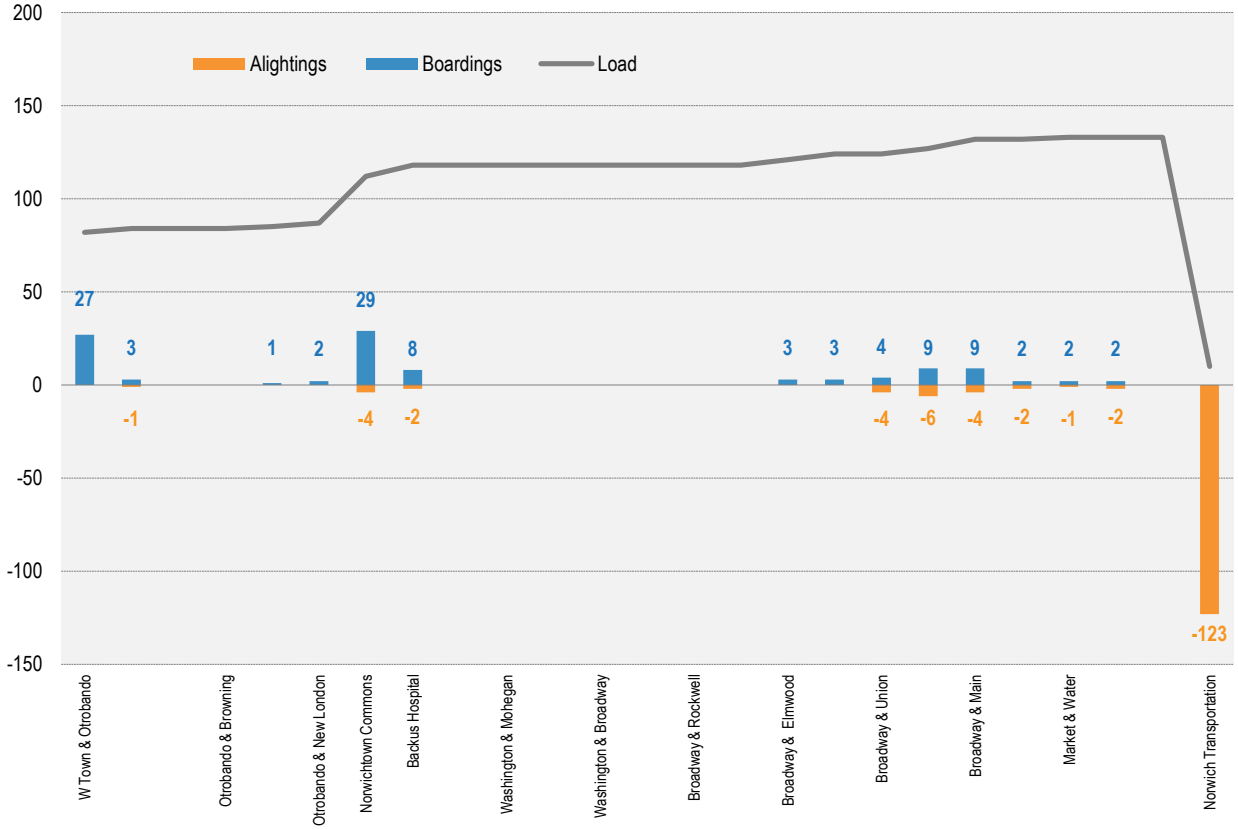
Ridership is particularly low along New Park Avenue in Franklin, and along Franklin Parkway and Otrobando Avenue in Norwich. In addition, Washington Street between Lafayette Street and Crescent Street exhibits no ridership (note that these segments are along the southbound portion of Run 5).

FIGURE 6 – NORTHBOUND WEEKDAY RIDERSHIP BY STOP CHART



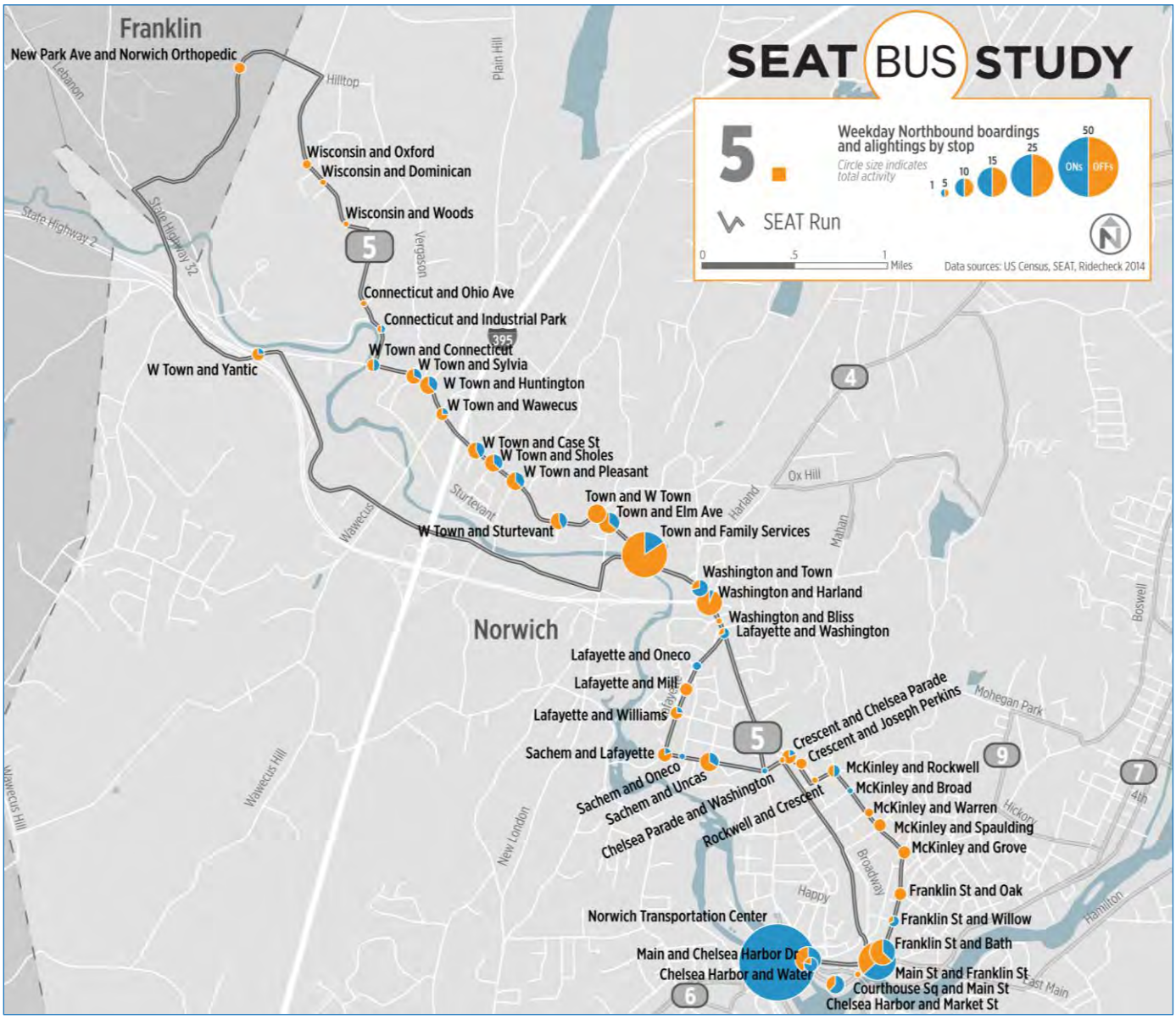
Source: SEAT Ridecheck 2014

FIGURE 7 – SOUTHBOUND WEEKDAY RIDERSHIP BY STOP CHART



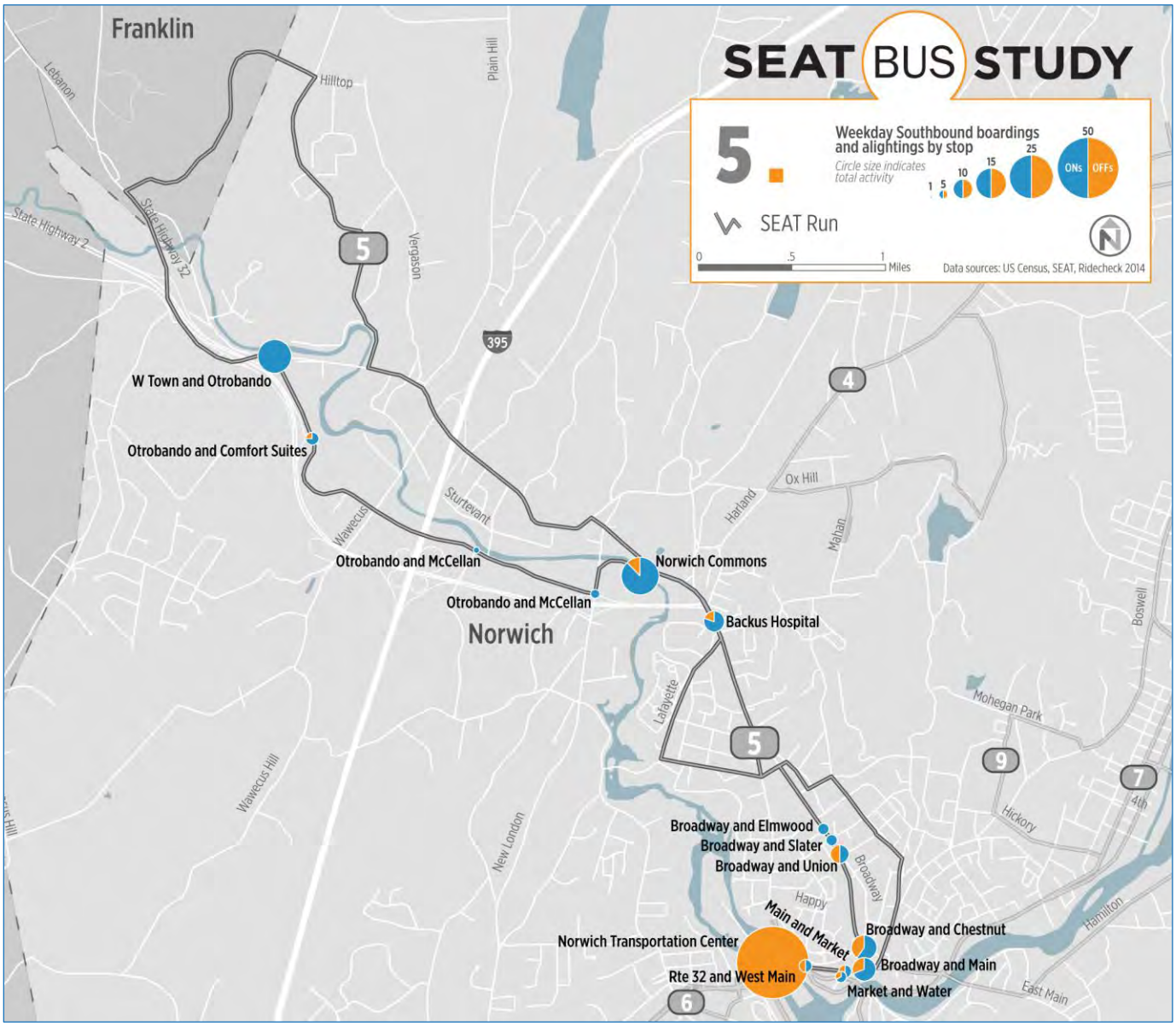
Source: SEAT Ridecheck 2014

FIGURE 8 – NORTHBOUND WEEKDAY RIDERSHIP BY STOP MAP



Source: SEAT Ridecheck 2014

FIGURE 9 – SOUTHBOUND WEEKDAY RIDERSHIP BY STOP MAP



Source: SEAT Ridecheck 2014

Ridership by Trip. Run 5 northbound trips operate with a consistently high ridership throughout the day, with most trips carrying between 20 and 30 passengers on average. Southbound ridership is noticeably lower, with all but one trip carrying 15 or fewer passengers. Southbound trips begin at 8:22 a.m., and ridership alternates between increasing and decreasing until the 1:22 p.m. trip, which averages 23 passengers. After that, ridership steadily declines over the afternoon and evening. The imbalance between northbound and southbound ridership suggests some combination of (a) an unusual ridership activity period during the ridecheck, and (b) that many riders are taking the run for travel in the northbound direction and using another service for the return part of their trip.

FIGURE 10 – NORTHBOUND WEEKDAY RIDERS PER TRIP

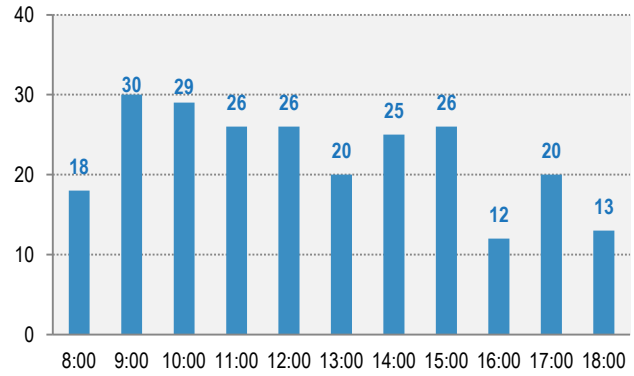
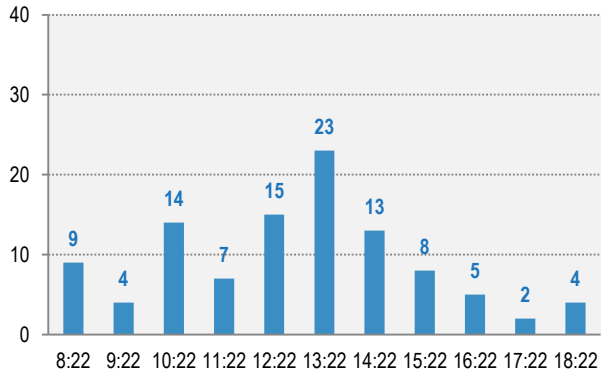


FIGURE 11 – SOUTHBOUND WEEKDAY RIDERS PER TRIP



Source: SEAT Ridecheck 2014

Performance. Overall, Run 5 performs much better than average among SEAT runs on all days of the week (see Figure 12). On weekdays, the run carries the third highest volume of passengers per revenue hour of any run, and the third highest volume of passengers per revenue mile (see Figure 12 and Figure 13). On Saturdays, Run 5 ranks fourth on both measures.

The run's average speed is slightly below the system average on both weekdays and Saturdays. However, although weekday on-time performance is 33% – far below average and the lowest in the SEAT system – the run's Saturday on-time performance is 84%, well above average and the highest of any Saturday run. The poor weekday on-time performance may be due to the run having high ridership and being slowed down due to the flag-down system.

FIGURE 12 – PERFORMANCE MEASURES

Performance Measure	Weekday		Saturday		Sunday	
	Run 5	System Avg	Run 5	System Avg	Run 5	System Avg
Passengers per Revenue Vehicle Hour	31.7	20.9	21.4	16.4	-	12.9
Passengers per Revenue Vehicle Mile	2.4	1.6	1.6	1.2	-	0.8
Average Speed (mph)	13.0	16.2	13.0	15.2		17.6
On-Time Performance Reliability*	33.0%	57.9%	84.4%	52.8%	-	40.8%

*On-Time Performance is the percent of sampled observations where the bus arrived at timepoints within 5 minutes of the scheduled time.
Source: SEAT Analysis Factors 2014

FIGURE 13 – WEEKDAY RIDERS PER REVENUE HOUR

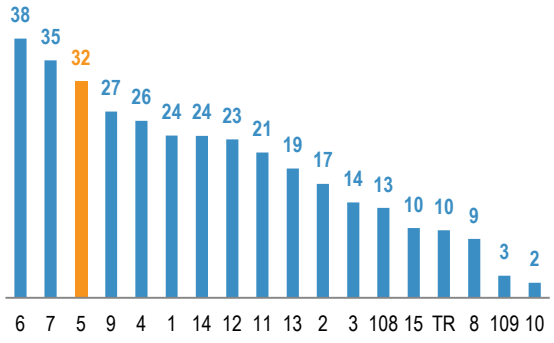
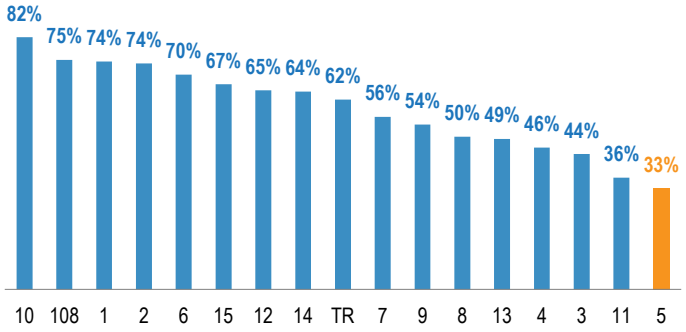


FIGURE 14 – WEEKDAY ON-TIME PERFORMANCE

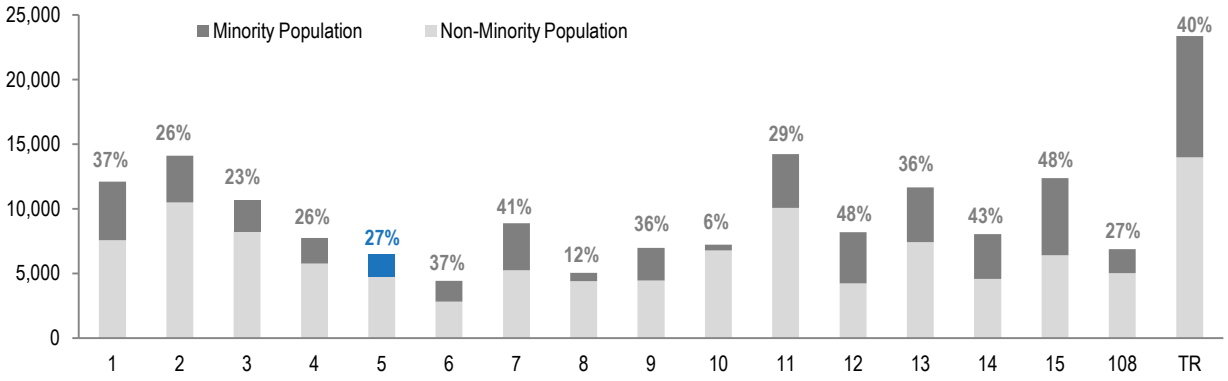


Source: SEAT Ridecheck 2014

Environmental Justice

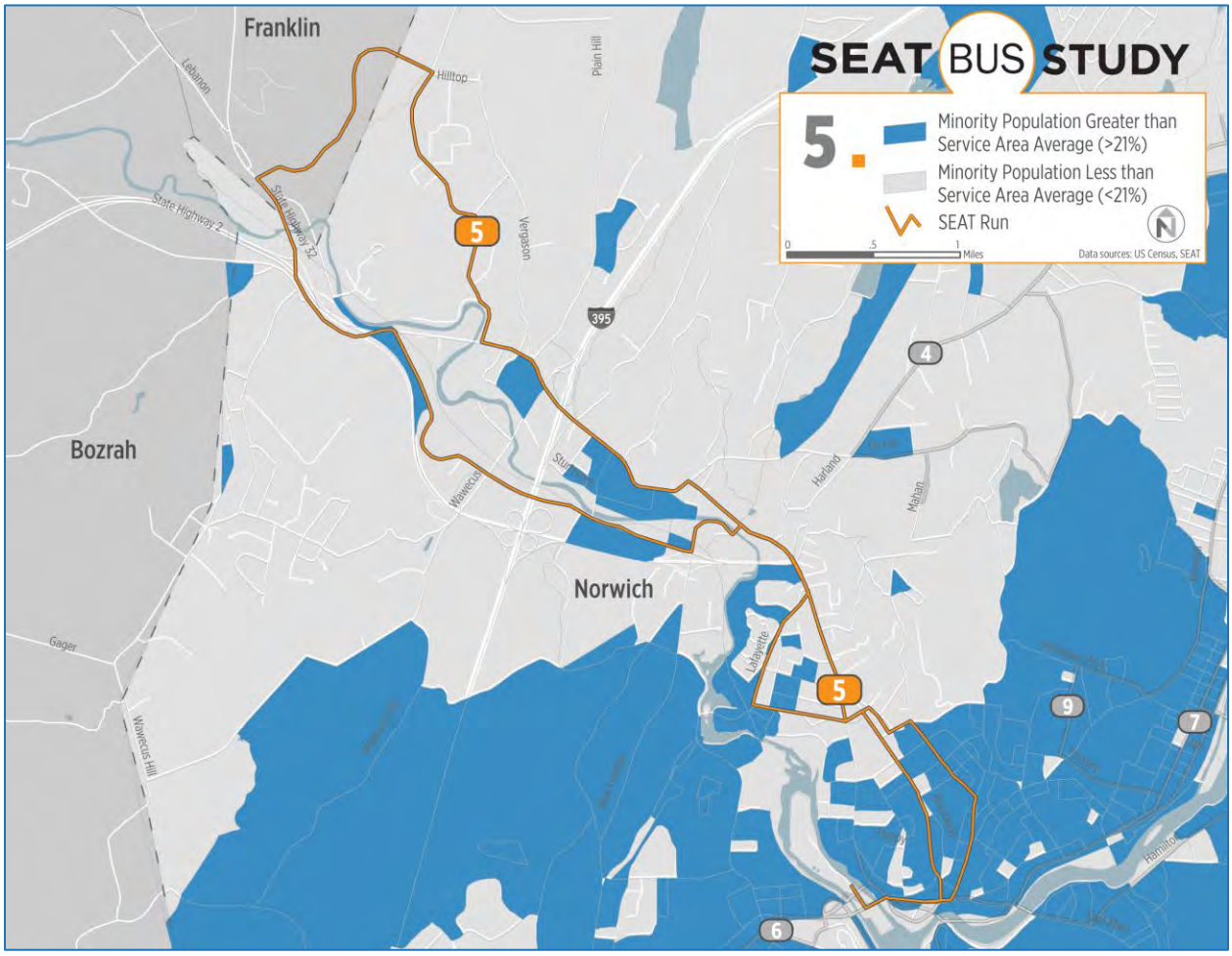
Run 5 predominately serves areas with a slightly higher minority population than is found in the SEAT service area overall. About one-quarter (27%) of the population served by Run 5 lives in census blocks that have a minority population greater than the overall service area average (21%). As shown in Figure 16, these minority populations are concentrated in downtown Norwich and along Town Street.

FIGURE 15 – SERVICE TO BLOCKS WITH HIGH MINORITY POPULATIONS



Sources: US Census 2010, SEAT

FIGURE 16 – MAP OF BLOCKS WITH HIGH MINORITY POPULATIONS



Sources: US Census 2010, SEAT

SERVICE IMPROVEMENT OPTIONS

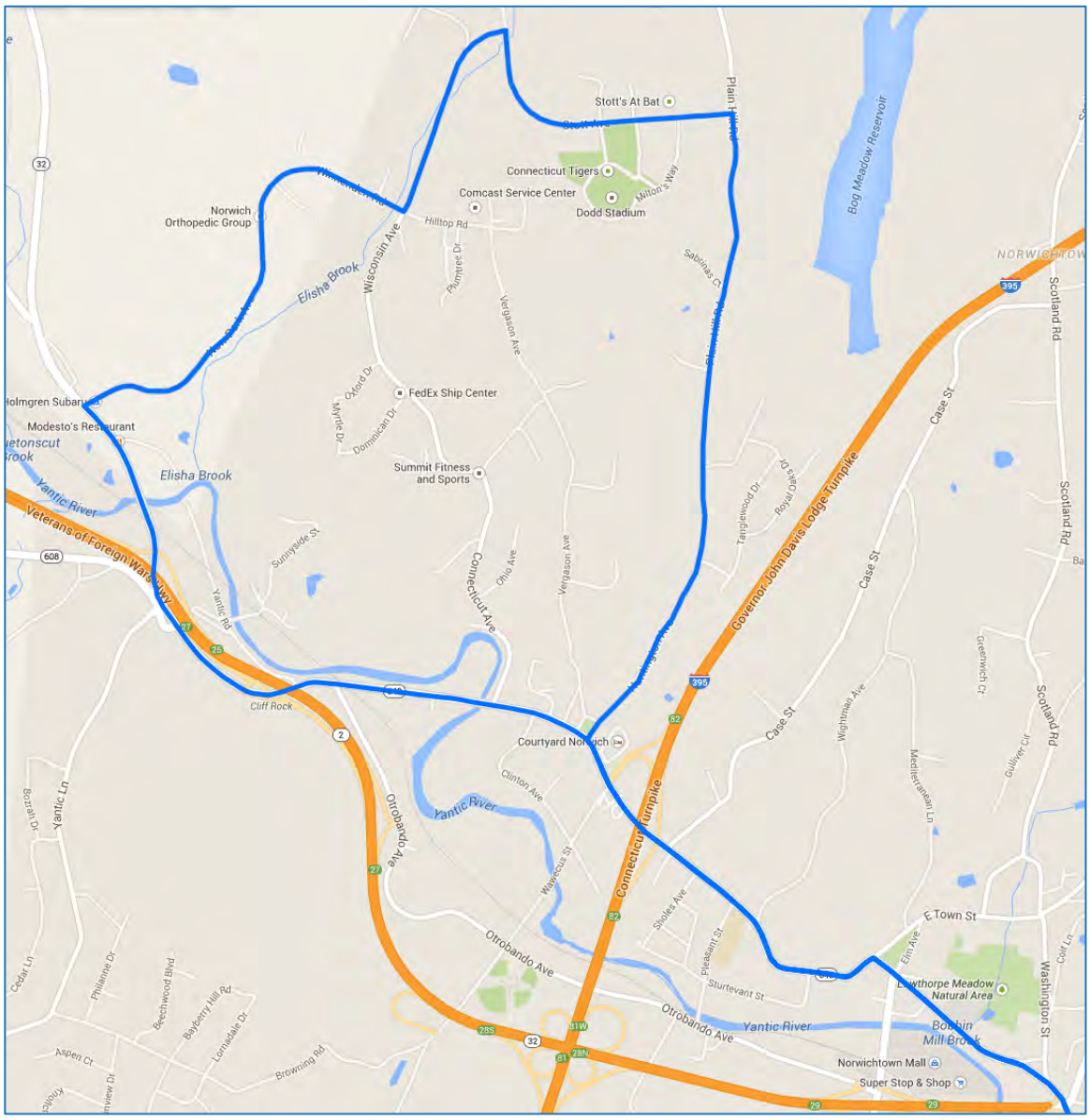
Run 5 is a relatively productive SEAT run. The run carries a fair number of riders and is among the most productive runs in the SEAT system, despite the indirect alignment and the large one-way loop north of Norwichtown shopping center. The run also operates at a consistent hourly frequency. However, Run 5 has the lowest on-time performance of any SEAT run (33%), perhaps because Run 5 is a high ridership run that is likely slowed down due to the flag-down system.

Most ridership is focused closer to downtown Norwich and along Town Street, with the highest ridership locations at Backus Hospital and Norwichtown Mall Shopping Center. Although there are several employment sites and multi-family residential complexes in the Norwich Business Park and other industrial sites along New Park Avenue in Franklin, there are no boardings between the Business Park and West Town Street at Yantic Road, and only 8 alightings along the same stretch. Similarly, ridership is low along most of Otrobando Avenue, with 5 boardings and 1 alighting between West Town Street and Norwichtown Commons.

Opportunities to improve Run 5 include:

- **Redesign the run to operate bidirectional service instead of a one-way loop.** Run 5 currently operates a large one-way loop north of Norwichtown Commons. While this loop provides more geographic coverage, it forces passengers to travel the entire length of the run in order to complete a round trip. Operating a run along one alignment in both directions would make service more direct and would make it easy for riders to make a return trip.
- **Serve the same streets in both directions where possible.** When traveling northbound, Run 5 serves Sachem Street and Lafayette Street before turning north on to Washington Street. However, southbound buses only serve Washington Street. Although the deviation onto Sachem and Lafayette may add slightly more time, there are more businesses and retail activities along these streets than on Washington, and operating along one consistent alignment in both directions would make it easier for riders to know where the bus will go and to complete return trips. In downtown Norwich, differing alignments would need to be maintained (Franklin and McKinley northbound, Broadway southbound) due to the presence of one-way streets.
- **Serve Industrial Park and other sites with vanpool service.** Given the low level of ridership to the industrial areas along the northern Run 5 loop, in addition to the difficulty of efficiently serving these dispersed employment sites and the lack of pedestrian infrastructure, a carpool or vanpool service may be better suited to provide access to the Industrial Park and nearby sites rather than fixed-route service. Vanpools would be able to serve the low amount of ridership more efficiently, and could be better matched with the actual shift schedules of these workers versus riders traveling to shopping and medical destinations on Town Street.
- **Start service earlier to better match demand.** Run 5 serves Backus Hospital, a major medical center with early and late shift times. Run 5's service span could be adjusted to better meet the demand for employee travel to/from work at their unique shift times. In particular, service could start an hour or two earlier in order to provide service that may work for early shift start and end times.
- **Simplify the north loop.** The northern section of the run is a large difficult to use loop, which could be simplified to focus on the most important areas for service. The Otrobando Avenue segment of the loop is very unproductive and generates little ridership activity, and could be discontinued, creating a streamlined terminal loop as illustrated in Figure 17. Such a redesign would also add bidirectional service on West Town Street to benefit riders along that segment.

FIGURE 17 – SAMPLE REDESIGN



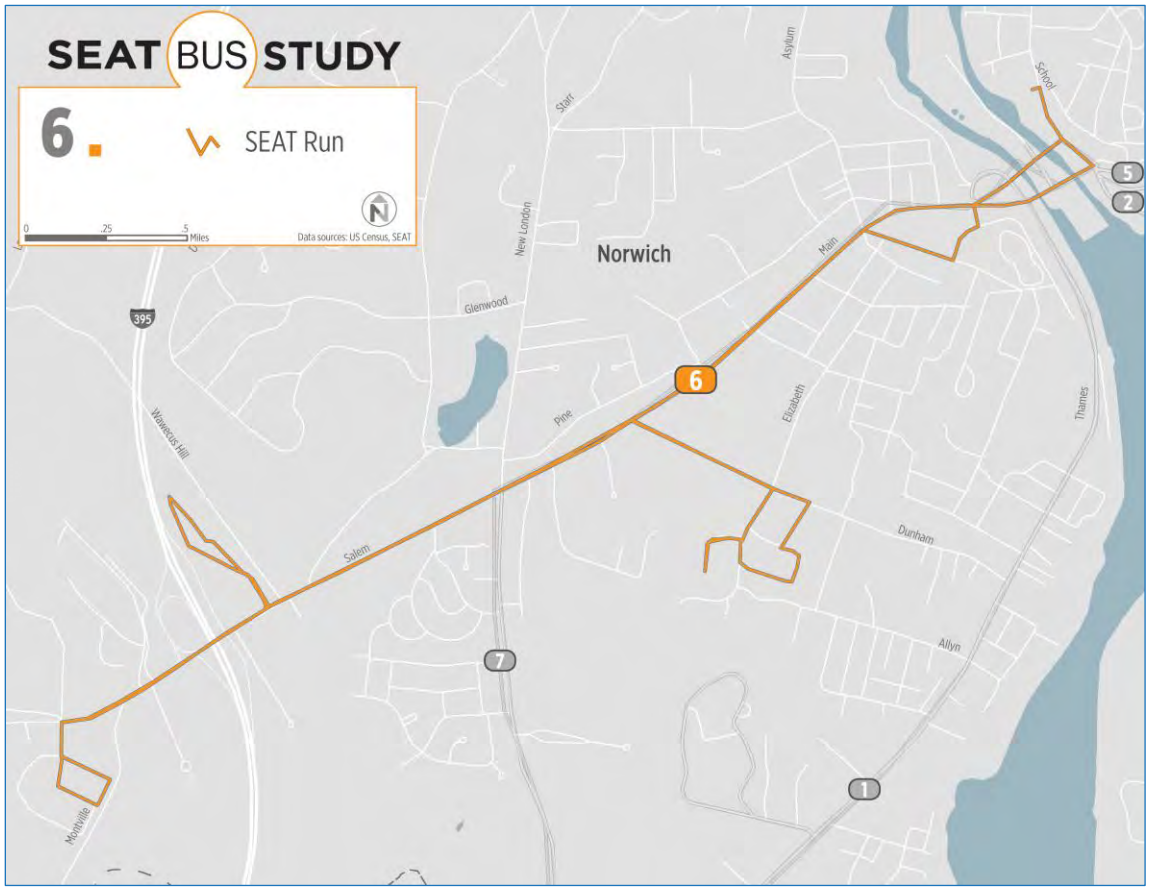
SERVICE EVALUATION

RUN 6 (WEST SIDE)

Service Design. Run 6 serves Norwich's West Side, and primarily operates along Main Street and Salem Turnpike. Westbound buses depart Norwich Transportation Center, circling east on Main Street, north on Washington Street, west on West Side Boulevard, south on High Street, and west on Mechanic Street before merging onto Main Street and traveling southwest. At Dunham Street, buses deviate east and complete a loop along Stanley Place, Clifton Place, Pembroke Avenue, and Elizabeth Street, with a small deviation to serve Westwood Park Apartments. Buses then return west along Dunham Street and continue southwest along Main Street, with small deviations to serve the Marcus Plaza shopping center (just east of New London Turnpike) and the Green Plains Plaza shopping center (just east of the Connecticut Turnpike). At Briar Lane, buses turn south to serve Wal-Mart and Big Y grocery store, completing a small terminal loop around the shopping center.

To complete an eastbound trip, Run 6 buses return northeast along Salem Turnpike and Main Street to the Norwich Transportation Center, serving Marcus Plaza and Dunham Street/Westwood Park Apartments along the way.

FIGURE 1 – RUN MAP



Service Schedule. Run 6 operates on weekdays and Saturdays, providing hourly service throughout the day on all service days. Weekday service operates from 7 AM to 6:30 PM, while Saturday service runs from 9 AM to 4:30 PM.

FIGURE 2 - SCHEDULE STATISTICS

Service Day	Span of Service	Frequency (min) Peak / Off-Peak	Daily Trips
Weekday	7:00 AM — 6:30 PM	60	26
Saturday	9:00 AM — 4:30 PM	60	18
Sunday	-	-	-

Source: SEAT Run Schedules

Interaction with System. Run 6 provides connections to other SEAT runs at the Norwich Transportation Center, and operates in parallel with some runs in Norwich:

- **Norwich Transportation Center.** Passengers can connect to SEAT runs 1, 2, 4, 5, 7, and 9. Runs 1 and 2 provide service between Norwich and New London. Runs 4 and 5 provide service to the northeast and northwest portions of Norwich. Run 7 travels to Mohegan Sun Casino and across southern Norwich. Run 9 travels between Norwich and Lisbon Landing, connecting to Run 8 at Lisbon Landing.
- **Main Street**. Run 6 provides bidirectional service along Main Street between New London Turnpike and Mechanic Street. SEAT Run 7, which operates as a large one-way loop in southeastern Norwich, provides eastbound service along Main Street from New London Turnpike to Norwich Transportation Center.

Ridership by Service Day. Run 6 is among the most productive runs in the SEAT system, due to high ridership. Weekday ridership averages 457 daily passengers, the third highest among all runs and nearly twice the system average, while ridership per trip (17.6) is also higher than the system average of 13.0 riders (see Figure 3). Saturday service also performs well, with the fifth highest daily ridership and above-average ridership per trip.

FIGURE 3 - RIDERSHIP STATISTICS

Service Day	Daily Ridership	Ridership per Trip	
	Run 6	Run 6	System Avg
Weekday	457	17.6	13.0
Saturday	219	12.2	9.5
Sunday	-	-	5.8

Source: SEAT Ridecheck 2014

FIGURE 4 - AVERAGE WEEKDAY RIDERSHIP

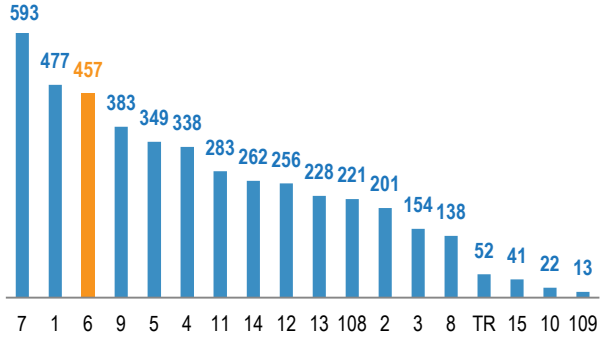
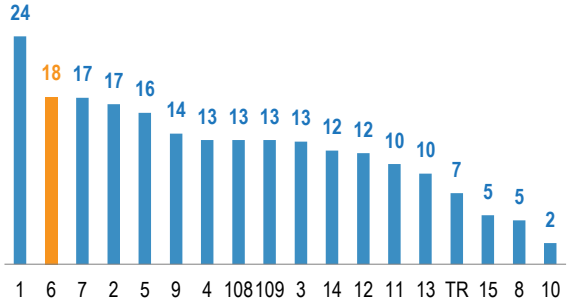


FIGURE 5 - AVERAGE WEEKDAY RIDERSHIP PER TRIP



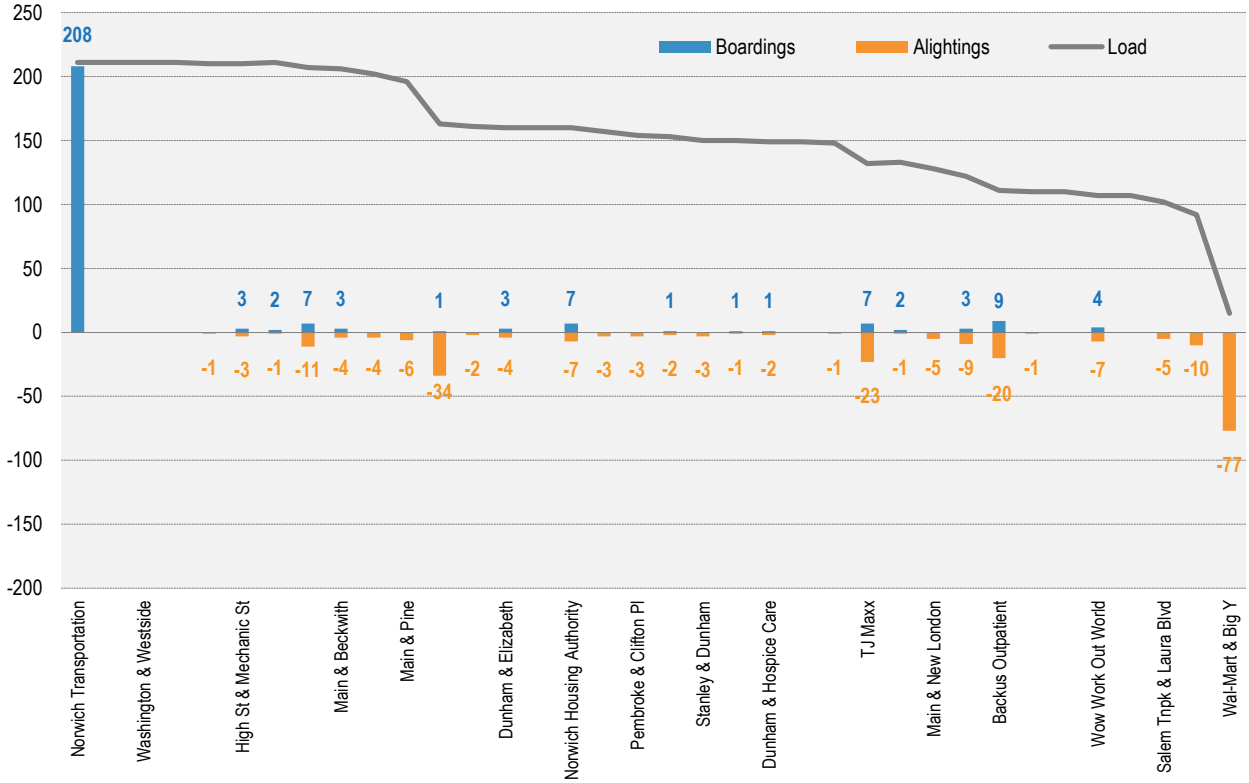
Source: SEAT Ridecheck 2014

Ridership by Stop. Ridership on Run 6 is high at the endpoints (Wal-Mart and the Norwich Transportation Center), but the run also has relatively significant activity distributed throughout the run's service area. Areas with high concentrations of ridership include:

- **Norwich Transportation Center.** There are 208 boardings and 164 alightings.
- **Wal-Mart/Big Y Grocery.** There are 77 boardings at the shopping center featuring Wal-Mart and Big Y grocery store, which serves as the western terminus of the run.
- **Marcus Plaza/TJMaxx.** Marcus Plaza, located along Main Street just east of New London Turnpike, has 54 boardings in the eastbound direction and 7 boardings in the westbound direction.
- The deviation at Dunham Street, which serves a residential area and the Norwich Housing Authority office, serves about 20 riders a day, or 8% of the run's activity. The diversion adds about 5 minutes of travel time for riders who ride through the diversion.
- The deviation to serve the Green Plains Plaza Shopping Center (Wow Work Out World, Backus Outpatient Center, and the CT Job Center) serves just under 5 riders per day (less than 1% of the run's ridership) and adds just under 5 minutes of travel time for those riding through the diversion.

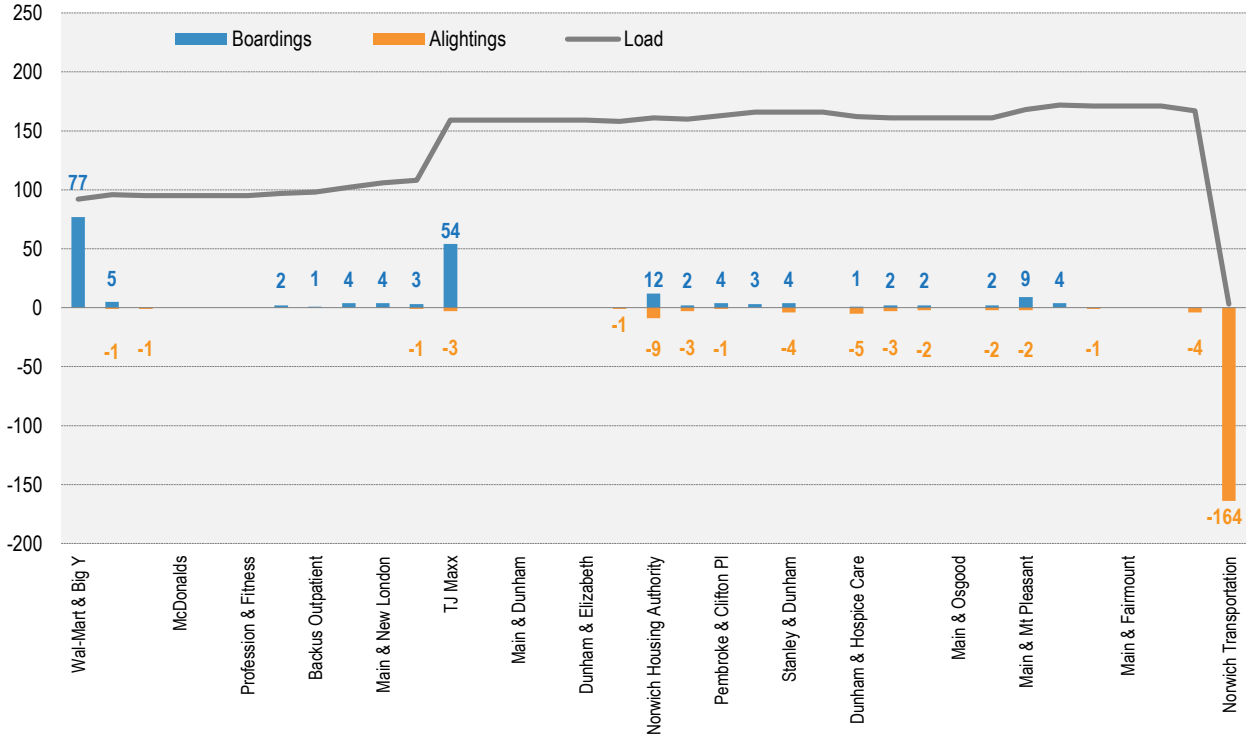
Westwood Park Apartments also has moderate ridership, with 12 passengers boarding eastbound and 7 boarding westbound.

FIGURE 6 – WESTBOUND WEEKDAY RIDERSHIP BY STOP CHART



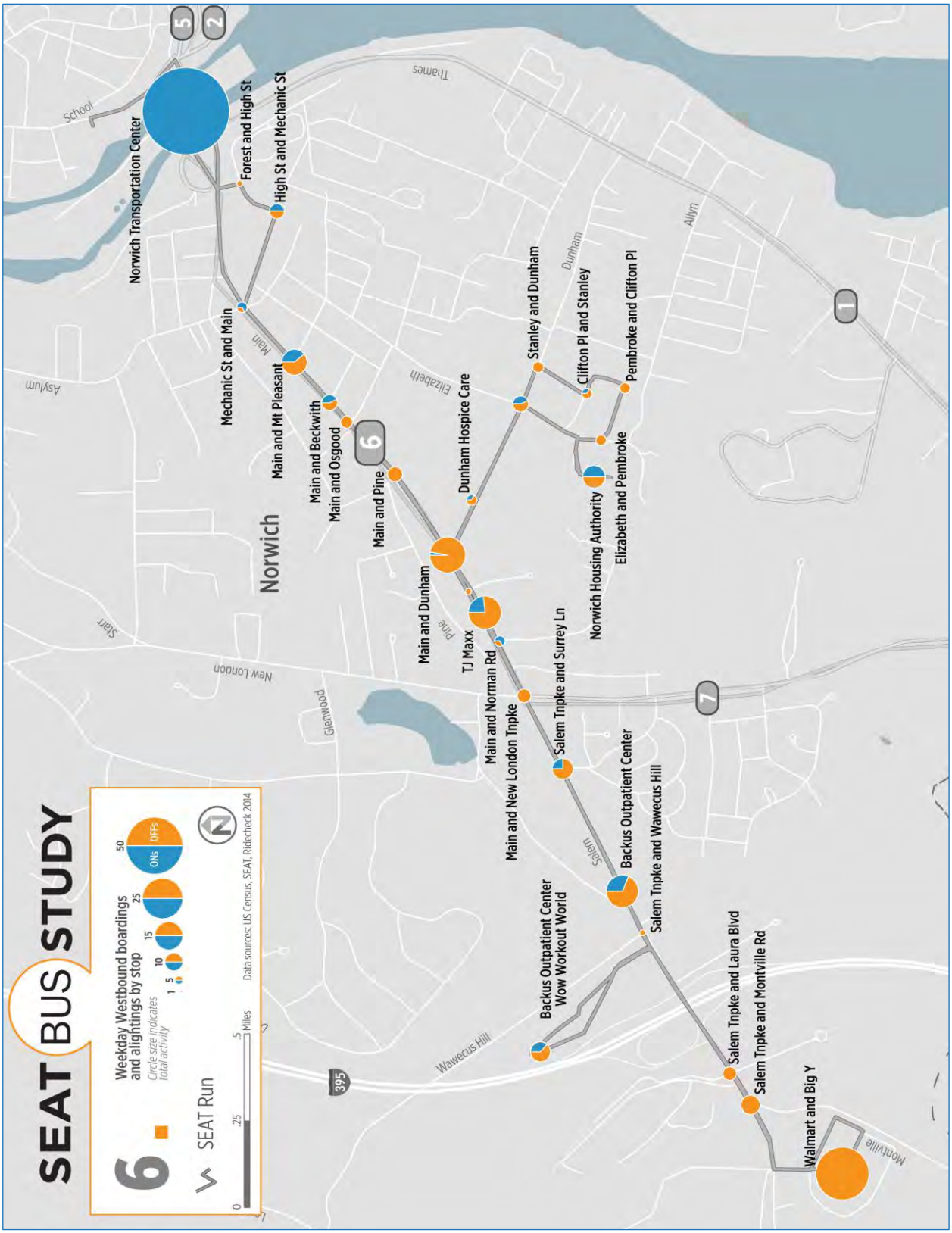
Source: SEAT Ridecheck 2014

FIGURE 7 – EASTBOUND WEEKDAY RIDERSHIP BY STOP CHART



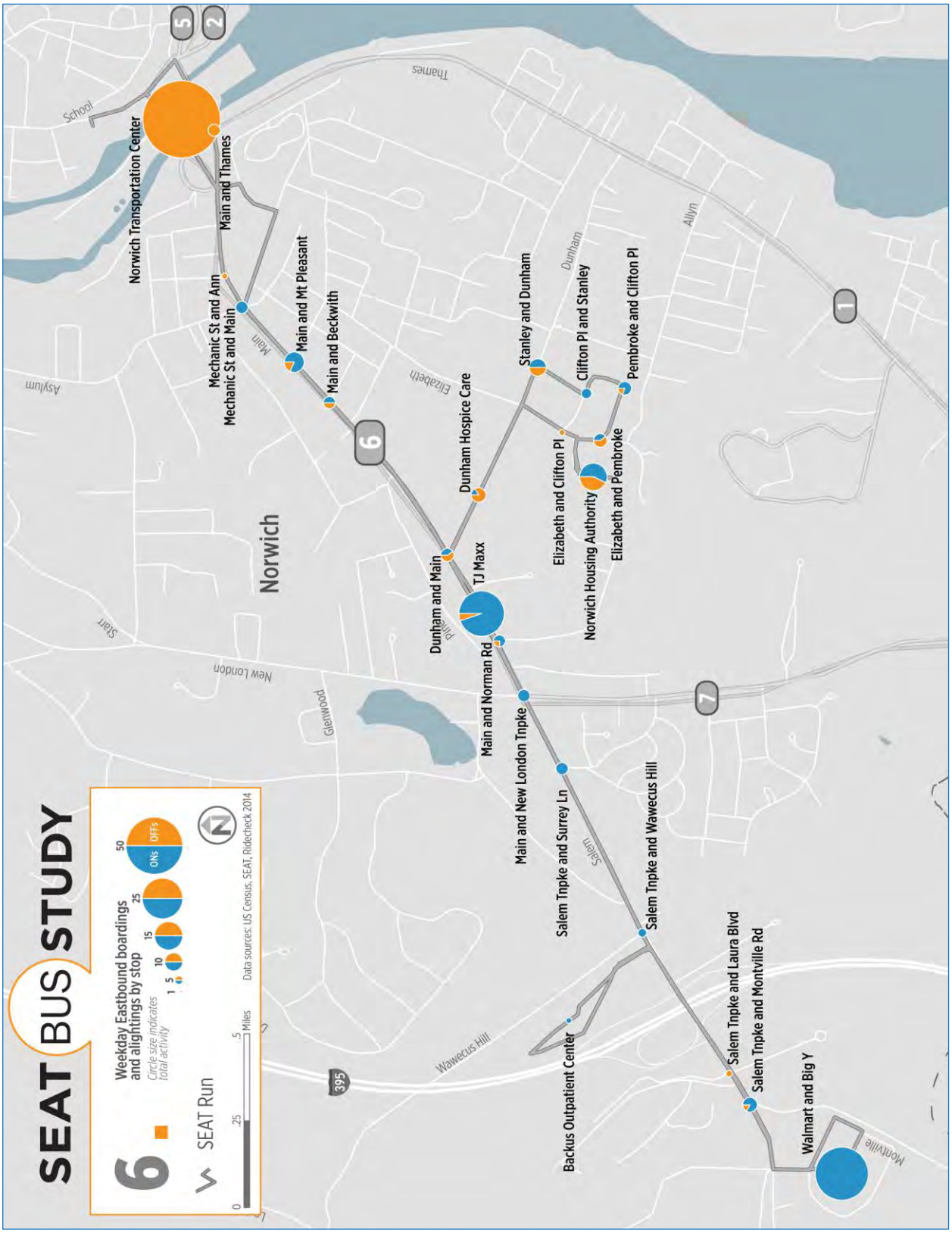
Source: SEAT Ridecheck 2014

FIGURE 8 – WESTBOUND WEEKDAY RIDERSHIP BY STOP MAP



Source: SEAT Ridecheck 2014

FIGURE 9 – EASTBOUND WEEKDAY RIDERSHIP BY STOP MAP



Source: SEAT Ridecheck 2014

Ridership by Trip. Ridership by trip is generally higher on westbound trips than on eastbound trips, which indicates that many riders are using run 7 to make some eastbound trips (see Figures 10 and 11). Ridership on Run 6 westbound service is generally highest in the late morning (9:00-11:00 a.m.) and in the afternoon (2:00 p.m. – 3:00 p.m.), with the highest ridership trip at 11:00 a.m. (44 passengers). Eastbound ridership is consistently between 10 and 15 riders per trip throughout the day, and peaks in the late morning (10:30 a.m. – 12:30 p.m.) and on the 4:30 p.m. trip. Eastbound ridership does not exceed 26 passengers per trip. The run's strong midday ridership is an indication that the run serves a strong non-commute market for a variety of trip purposes.

FIGURE 10 – WESTBOUND WEEKDAY RIDERS PER TRIP

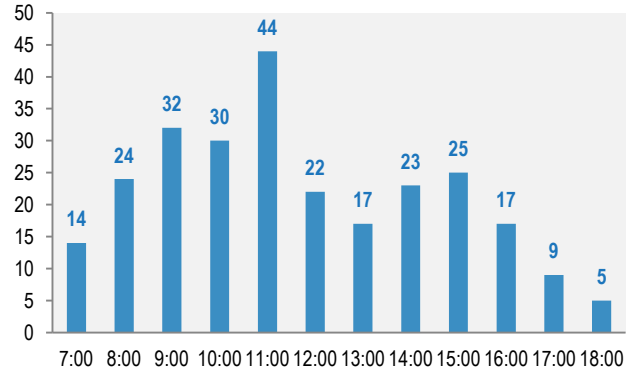
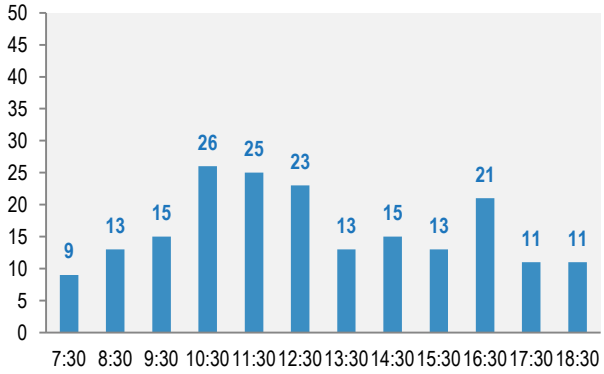


FIGURE 11 – EASTBOUND WEEKDAY RIDERS PER TRIP



Source: SEAT Ridecheck 2014

Performance. Run 6 is a top-performing run in the SEAT system, largely due to its high ridership along a relatively short alignment. The run ranks first among all runs in terms of passengers per vehicle hour and passengers per vehicle mile, on both weekdays and Saturdays (see Figure 12 and 13). On weekdays, the run's volume of passengers per vehicle hour is over 80% above the system average, while volume of passengers per vehicle mile is more than twice the average.

Run 6 operates below the average system speed on both weekdays and Saturdays. Despite this slow speed, the run's weekday on-time performance is above average at nearly 70%, although Saturday service operates somewhat below average at 42%, perhaps due to the commercial activity along Main Street and Salem Turnpike.

FIGURE 12 - PERFORMANCE MEASURES

Performance Measure	Weekday		Saturday		Sunday	
	Run 6	System Avg	Run 6	System Avg	Run 6	System Avg
Passengers per Revenue Vehicle Hour	38.1	20.9	27.4	16.4	-	12.9
Passengers per Revenue Vehicle Mile	3.7	1.6	2.7	1.2	-	0.8
Average Speed (mph)	10.2	16.2	10.2	15.2		17.6
On-Time Performance Reliability*	69.8%	57.9%	42.2%	52.8%	-	40.8%

*On-Time Performance is the percent of sampled observations where the bus arrived at timepoints within 5 minutes of the scheduled time.
Source: SEAT Analysis Factors 2014

FIGURE 13 – WEEKDAY RIDERS PER REVENUE HOUR

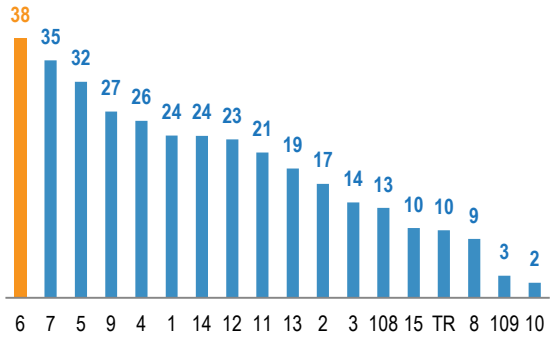
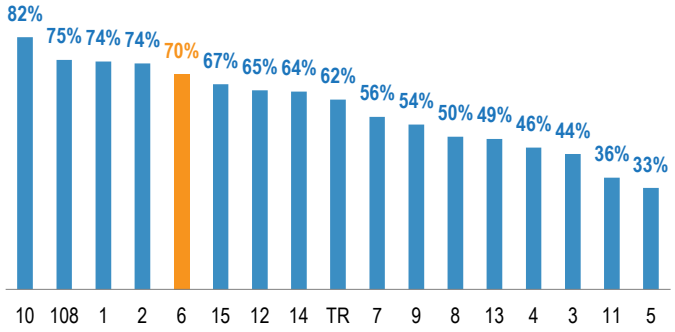


FIGURE 14 – WEEKDAY ON-TIME PERFORMANCE



Source: SEAT Ridecheck 2014

Environmental Justice

Run 6 predominately serves areas with a slightly higher minority population than is found in the SEAT service area overall. Over one-third (37%) of the population served by Run 6 lives in census blocks that have a minority population greater than the overall service area average (21%). As shown in Figure 16, these minority populations are concentrated along Salem Turnpike west of New London Turnpike, as well as along Main Street in Westside Norwich .

FIGURE 15 – SERVICE TO BLOCKS WITH HIGH MINORITY POPULATIONS

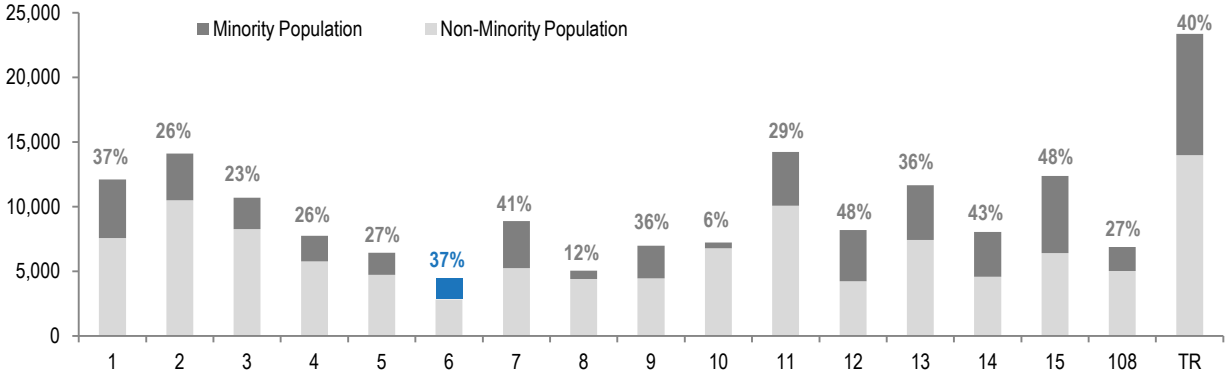
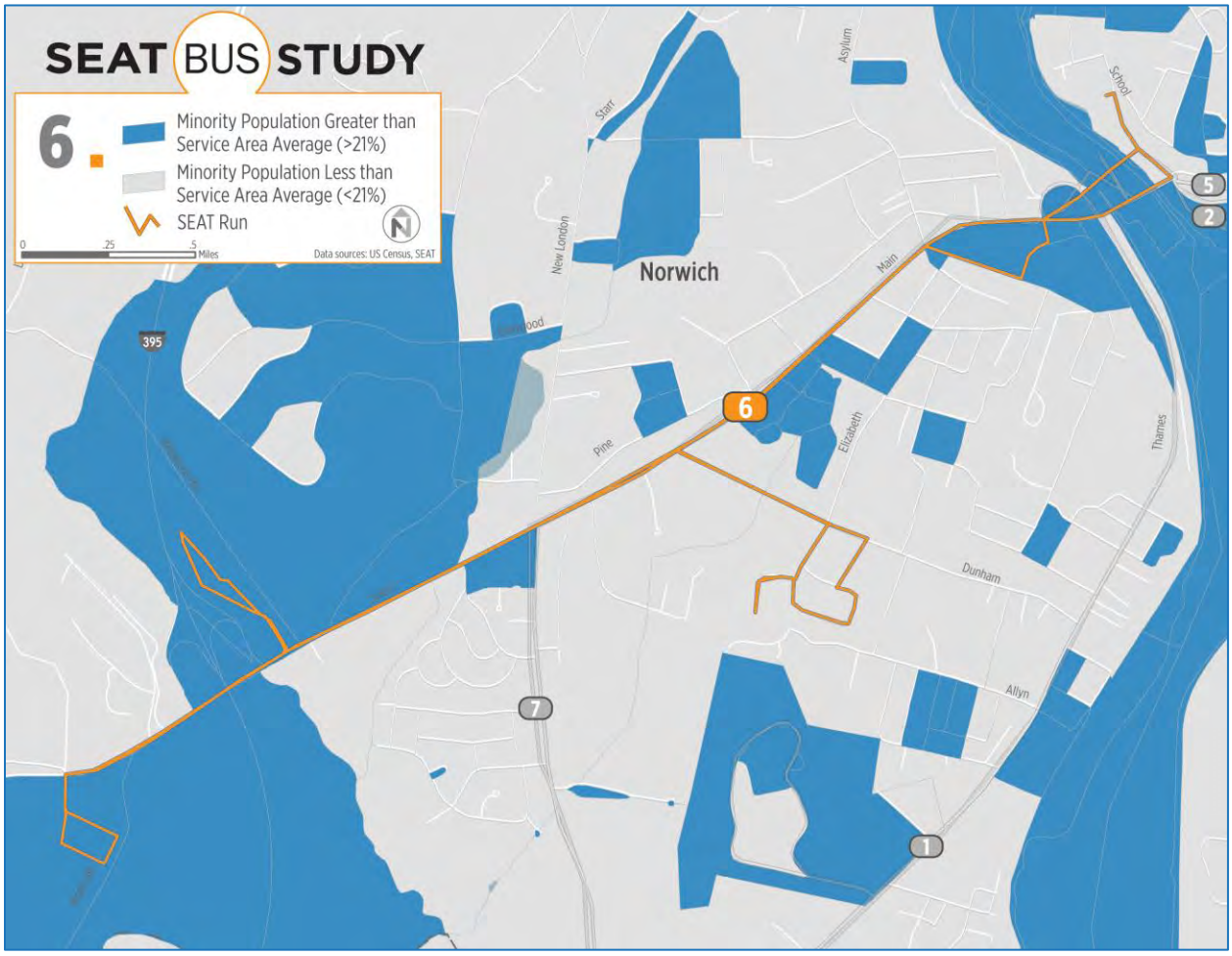


FIGURE 16 – MAP OF BLOCKS WITH HIGH MINORITY POPULATIONS



Source: U.S. Census

SERVICE IMPROVEMENT OPTIONS

Run 6 has high ridership and is the most productive run in the SEAT system, the highest volume of passengers per revenue hour and per revenue mile on both weekdays and Saturdays. Although the run has among the lowest average speeds in the system, it still achieves 70% on-time performance on weekdays, which is relatively strong among all SEAT runs. Although Run 6 travels primarily along Main Street and Salem Turnpike, there a few deviations to certain destinations that nearly double the mileage of the run and add significant travel time to riders traveling through the deviations. Opportunities to improve Run 6 include:

- **Increase service frequency.** Considering the high level of ridership on Run 6, particularly during the late morning and mid-day hours, increasing the frequency of service may help boost ridership and position Run 6 as a core local run.
- **Discontinue deviation to Green Plains Plaza Shopping Center.** The deviation to Green Plains Plaza Shopping Center (Wow Work Out World, a health center, and the Connecticut Job Center) near Wawecus Hill Road serves very few riders and adds nearly 5 minutes of travel time for the overwhelming majority of riders who travel through the deviation. The deviation could be discontinued in order to improve through travel time on the run. Riders who want to access the center can board and alight on the Salem Turnpike (there are pedestrian crossings at the center entrance), and the walk to the front door of all of the businesses is within 1/3-mile.
- **Improve the pedestrian environment at Green Plains Shopping Center.** In coordination with the previous service improvement option that would discontinue the deviation into the shopping center, the pedestrian environment could be improved for riders that would access the center from a stop on Salem Turnpike. Currently there are no sidewalks from the road into the center, for example. Adding sidewalks and a shelter would improve the pedestrian experience for riders accessing the center.
- **Shorten the Dunham Street deviation.** The deviation at Dunham Street to serve the residential areas along Dunham, Elizabeth, Clifton Place, and the Norwich Housing Authority office adds significant travel time for the majority of riders who ride through the deviation. The deviation serves a residential area that does generate some activity and the housing office is also important to serve, though these locations are geographically isolated and difficult to serve effectively. The deviation could be shortened so that it doesn't add so much through travel time to the majority of riders who are riding through.
- **Serve Dunham Street deviation with alternative run.** Again, the Dunham Street deviation adds significant though travel time to Run 6 and could be better served with another run. The areas along the deviation would be better served with a run focused on geographic coverage and not Run 6, which is a core corridor service that should offer straight and direct service. The deviation could be shifted to another run to maintain service but allow Run 6 to focus on its primary market.
- **Operate service later.** Run 6 provides service along West Main Street and Salem Turnpike, which is an important commercial corridor and includes Wal-Mart at the western terminus. Run 6 could be extended to operate later into the evening, which would better accommodate the variety of shopping and service related trips (particularly on Saturdays).

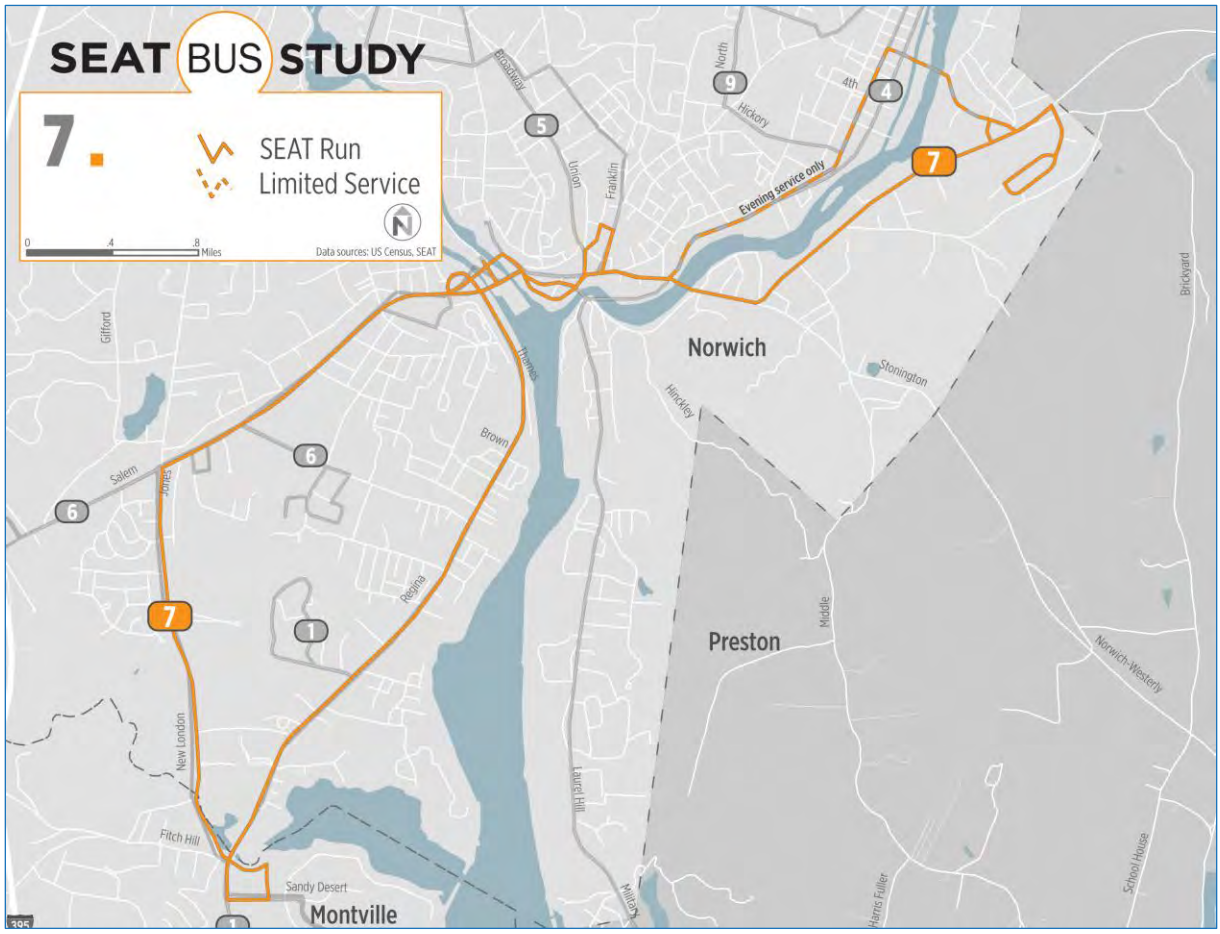
SERVICE EVALUATION

RUN 7 (HAMILTON AVE / MOHEGAN SUN / NL TPKE / W MAIN)

Service Design. Run 7 primarily operates in Norwich, serving the East Side of Norwich, downtown, the West Side, and Mohegan Sun Casino.

The daytime run begins at the Norwich Transportation Center, proceeding north on West Main Street and Chelsea Harbor Drive. The run then crosses the Bernham Bridge on East Main Street and continues north on Hamilton Avenue (Route 165). At the Hamilton Avenue Playground, the run loops to serve Donahue Drive and Quarto Road before returning back to Hamilton Avenue. The run deviates to serve AHEPA senior housing before returning on Hamilton Avenue, East Main Street, and the Bernham Bridge to downtown Norwich. Downtown, Run 7 deviates to serve Franklin Street, Willow Street, and Broadway before rejoining Main Street, Market Street, Water Street, and Westside Boulevard. The run skips the Transportation Center and proceeds south on Norwich's West Side. The run then does a large clockwise loop in the West Side, serving West Thames Street, Mohegan Sun, then returning northbound on the New London Turnpike, and West Main Street before pulling into the Norwich Transportation Center.

FIGURE 1 - RUN MAP



In the evenings between 7:00 PM and 10:00 PM, the run operates on a counter-clockwise loop in Norwich's East Side. Unlike during the day, the run provides one-way service on Hamilton Avenue. On its return trip back to downtown Norwich, the evening run uses Smith Avenue, crossing 8th Avenue, then southbound on Central Avenue, North Main Street, and Main Street (deviating on Franklin Street, Willow Street, and Chestnut Street, like in daytime). The rest of the run is consistent with daytime service. Sunday service also uses this modified alignment all day.

Service Schedule. Run 7 has different service patterns depending on the time of day. On weekdays and Saturday, the daytime service pattern operates from 6:00 AM until 6:00 PM. From 7:00 PM until 10:00 PM, the service uses the evening run. Service operates every hour Monday through Saturday, although Sunday service is increased but irregular, with an average frequency of every 30 minutes.

FIGURE 2 - SCHEDULE STATISTICS

Service Day	Span of Service	Frequency (min) Peak / Off-Peak	Daily Trips
Weekday	6:00 AM — 10:00 PM	60	34
Saturday	6:00 AM — 10:00 PM	60	34
Sunday	5:45 AM — 1:30 PM	Irregular (30-min avg.)	30

Source: SEAT Run Schedules

Interaction with System. Run 7 operates to the Norwich Transportation Center, which is a major transfer point with other local and regional SEAT services. In addition to this major transfer point, Run 7 interacts with the following runs:

- Run 1/101 operates parallel bidirectional service on West Thames Street, also providing service to the Mohegan Sun Casino.
- The Three Rivers Community College Express run provides afternoon service that provides parallel service on West Main Street and the New London Turnpike in the opposite direction of Run 7, operating eastbound on this alignment. The service also connects the Three Rivers Community College to the Norwich Transportation Center.
- North Main Street also hosts Run 9, which provides bidirectional service on the corridor until 8:00 PM. One trip overlaps with Run 7's evening service, which operates on Central Avenue and North Main Street in the southbound direction. Departures are staggered about 30 minutes apart.

Ridership by Service Day. Run 7 has the highest total weekday ridership of any run in the system, with 593 riders on weekdays, 369 on Saturdays, and 154 on Sundays (see Figures 3 through 5). However, due to a high number of trips provided, the run carries the third highest number of weekday riders per trip (17.4) among the SEAT system. Weekday and Saturday service carries more riders per trip than the SEAT average, while Sunday service carries fewer than the SEAT average.

FIGURE 3 - RIDERSHIP STATISTICS

Service Day	Daily Ridership	Ridership per Trip	
	Run 7	**Run 7**	**System Avg**
Weekday	593	17.4	13.0
Saturday	369	11.6	9.5
Sunday	154	5.1	5.8

Source: SEAT Ridecheck 2014

FIGURE 4 - AVERAGE WEEKDAY RIDERSHIP

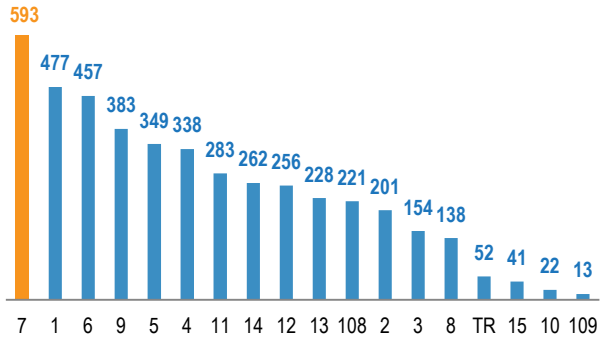
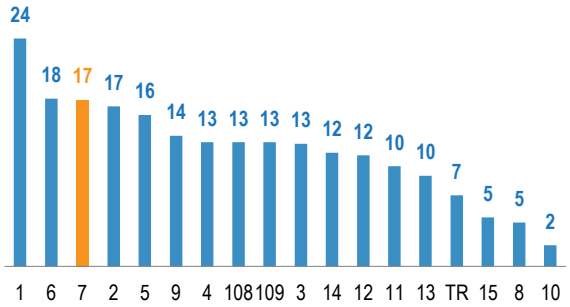


FIGURE 5 - AVERAGE WEEKDAY RIDERSHIP PER TRIP



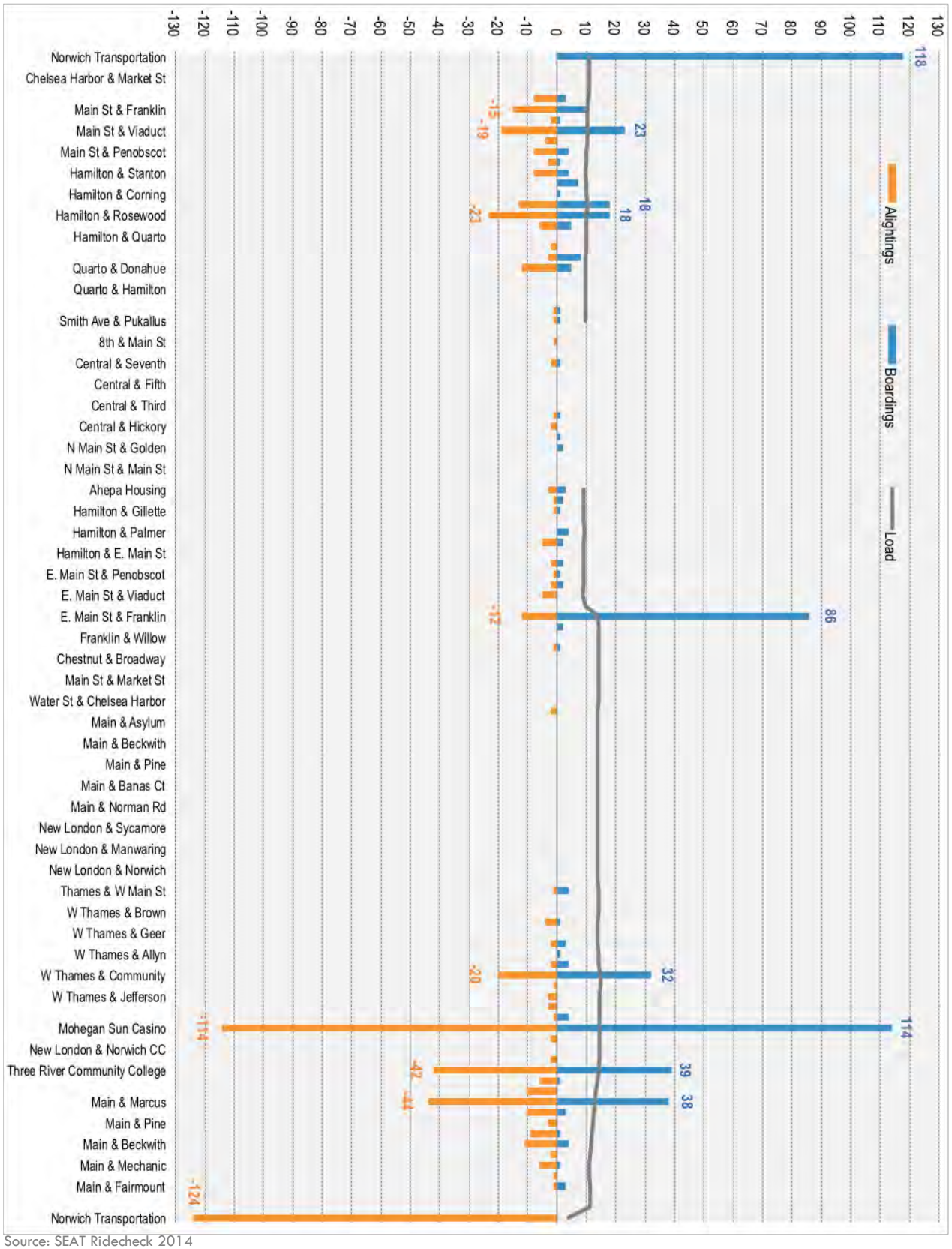
Source: SEAT Ridecheck 2014

Ridership by Stop. Ridership is primarily concentrated at the major activity centers that the line serves, such as the Norwich Transportation Center, Three Rivers Community College and the Mohegan Sun Casino (see Figures 6 and 7). The following stops have comparatively high activity compared to others:

- **Norwich Transportation Center.** The transportation center has an average of 118 daily boardings and 124 daily alightings.
- **East Main Street at Franklin Street.** This segment of Run 7 has an average of 86 boardings and 13 alightings per day. This area is in central Norwich, with an excellent pedestrian environment and access to a number of downtown businesses.
- **Mohegan Sun Casino** is a major ridership generator with 114 boardings and 114 alightings.
- **Three Rivers Community College** has 39 boardings and 42 alightings. While the run carries a significant number of riders to and from the college, it may serve more of the college market if service were faster and more direct.
- **Main Street at Marcus Plaza** is a major shopping center with several large stores. There are 38 boardings and 44 alightings at this stop.
- **West Thames Street at Thames River Community Service, Inc** is a transitional living apartment complex located near Everett Street. The stop has 32 boardings and 20 alightings. There are several strip mall stores located in close proximity to this stop. Note that this area is the only stop along West Thames Street with significant activity — other stops along West Thames Street each serve less than ten daily riders.
- **Main Street at Viaduct Street** has 23 boardings and 19 alightings. This stop is located on the eastern side of downtown Norwich near the Bernham Bridge. There are several businesses located nearby the stop.
- The Central Avenue and North Main Street segments on the evening and Sunday alignment serve very few riders.
- The diversion in central Norwich (along Franklin, Willow, and Chestnut Streets) carries very few riders. Only two riders board and alight along this diversion.

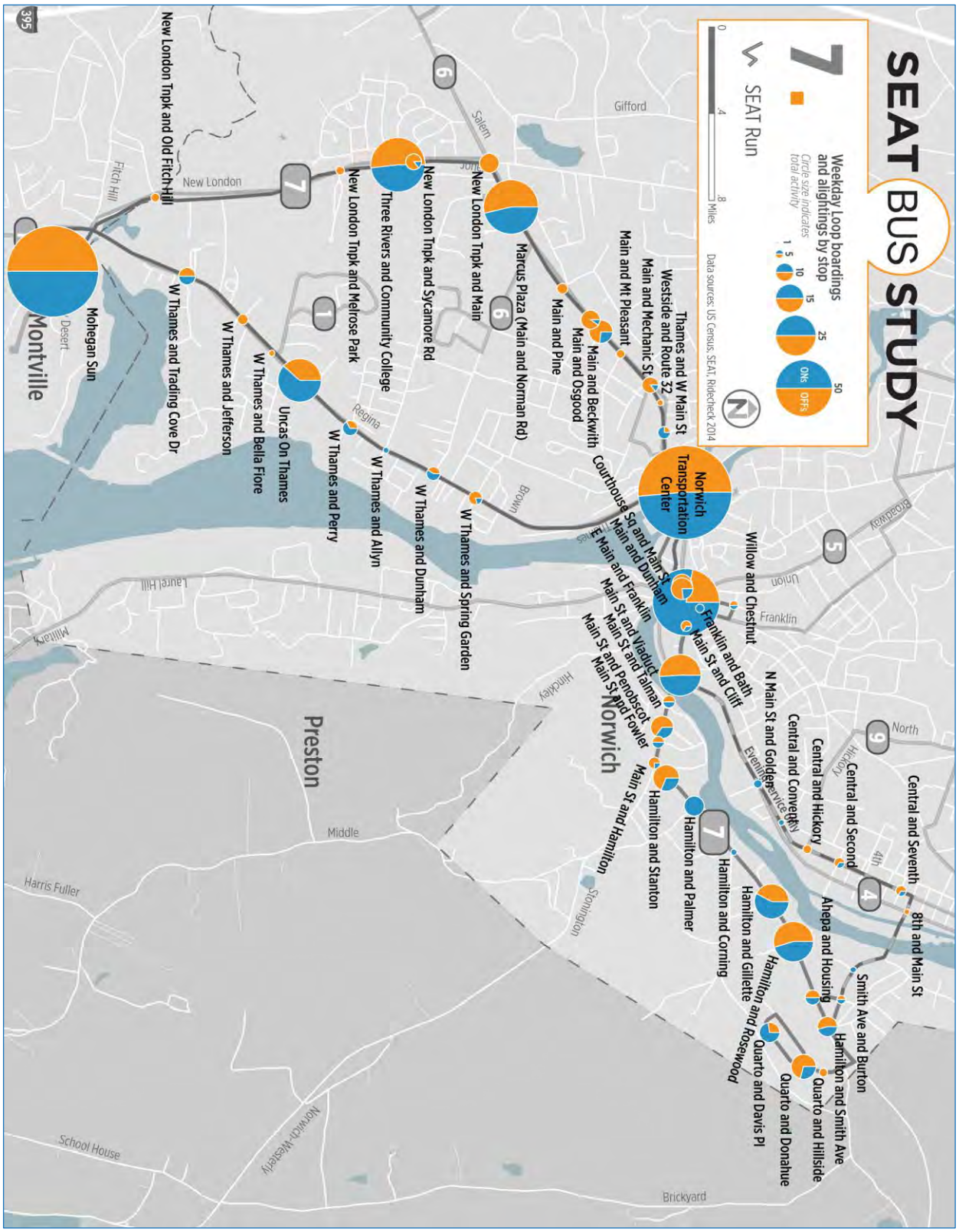
An important finding that is revealed in ridership data is that ridership on the southern portion is higher than the northern part of the run. This is due to the strong presence of activity centers and institutions on the southern side.

FIGURE 6 – ROUNDTRIP LOOP WEEKDAY RIDERSHIP BY STOP CHART



Source: SEAT Ridecheck 2014

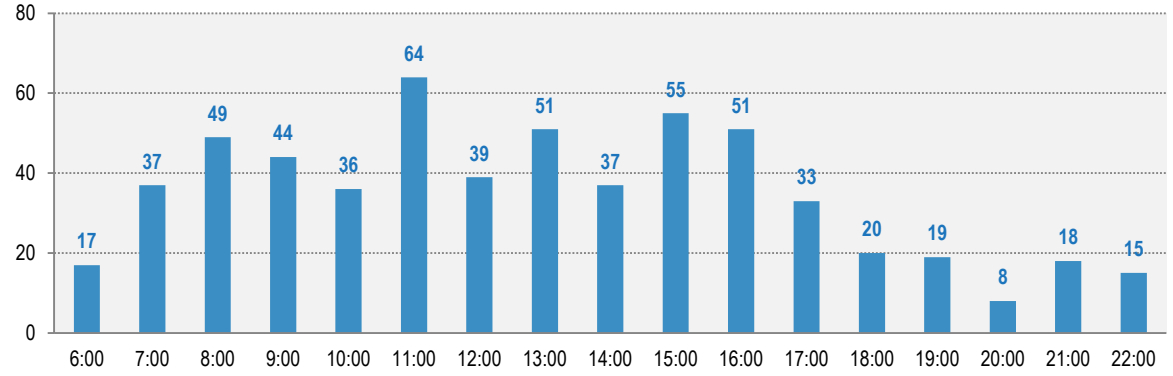
FIGURE 7 – ROUNDTRIP LOOP WEEKDAY RIDERSHIP BY STOP MAP



Source: SEAT Ridecheck 2014

Ridership by Trip. Ridership on Run 7 is relatively distributed throughout the morning and afternoon, with the strong ridership during the midday (see Figure 8). After 6:00 PM, ridership drops significantly, serving no more than 20 riders per trip. The strong midday activity indicates the run serves a large non-commute market with all-day trip purposes.

FIGURE 8 – ROUNDTRIP LOOP WEEKDAY RIDERS PER ROUNDTRIP



Source: SEAT Ridecheck 2014

Performance. Run 7 is a top performer among SEAT services, largely due to high ridership and it serving major destinations such as Mohegan Sun Casino and Three Rivers Community College (see Figure 9). Run 7 is the second most productive run in the system with 34.9 passengers per revenue hour on weekdays, compared to 20.9 on the system as a whole (see Figure 10). Saturdays and Sundays also present a similar image, averaging 21.7 and 19.3 passengers per hour respectively, compared to 16.4 and 12.9 on the systemwide level.

On-time performance, like with many other SEAT runs in city centers, is a major issue. Although Run 7 ranks in the middle in terms of on-time performance, over 43% of weekday trips arrive late (see Figure 11).

FIGURE 9 - PERFORMANCE MEASURES

Performance Measure	Weekday		Saturday		Sunday	
	Run 7	System Avg	Run 7	System Avg	Run 7	System Avg
Passengers per Revenue Vehicle Hour	34.9	20.9	21.7	16.4	19.3	12.9
Passengers per Revenue Vehicle Mile	2.8	1.6	1.7	1.2	1.5	0.8
Average Speed (mph)	12.6	16.2	12.6	15.2	12.6	17.6
On-Time Performance Reliability*	56.1%	57.9%	41.8%	52.8%	53.7%	40.8%

*On-Time Performance is the percent of sampled observations where the bus arrived at timepoints within 5 minutes of the scheduled time.
Source: SEAT Analysis Factors 2014

FIGURE 10 – WEEKDAY RIDERS PER REVENUE HOUR

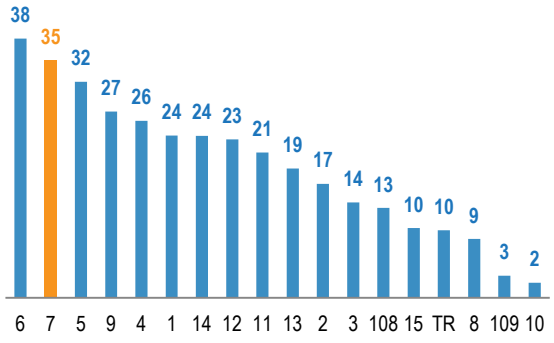
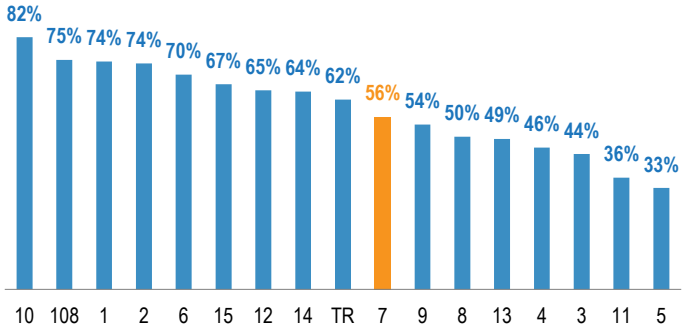


FIGURE 11 – WEEKDAY ON-TIME PERFORMANCE

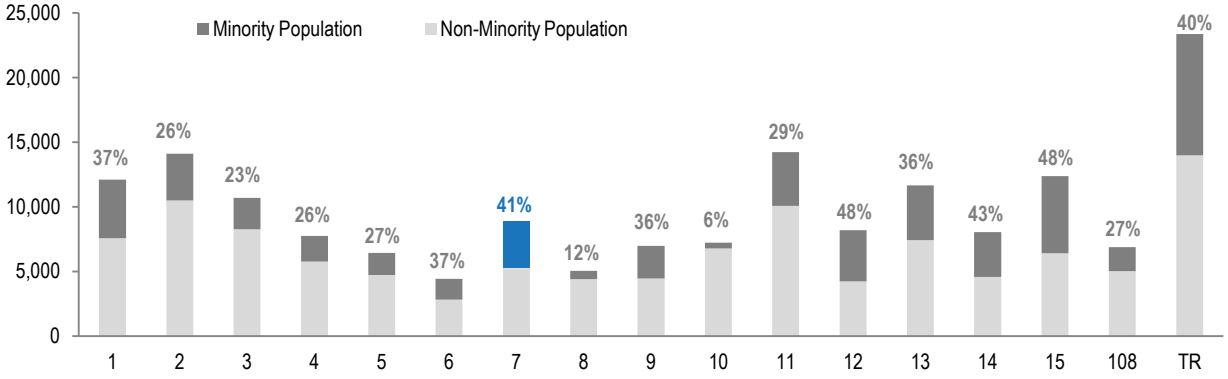


Source: SEAT Ridecheck 2014

Environmental Justice

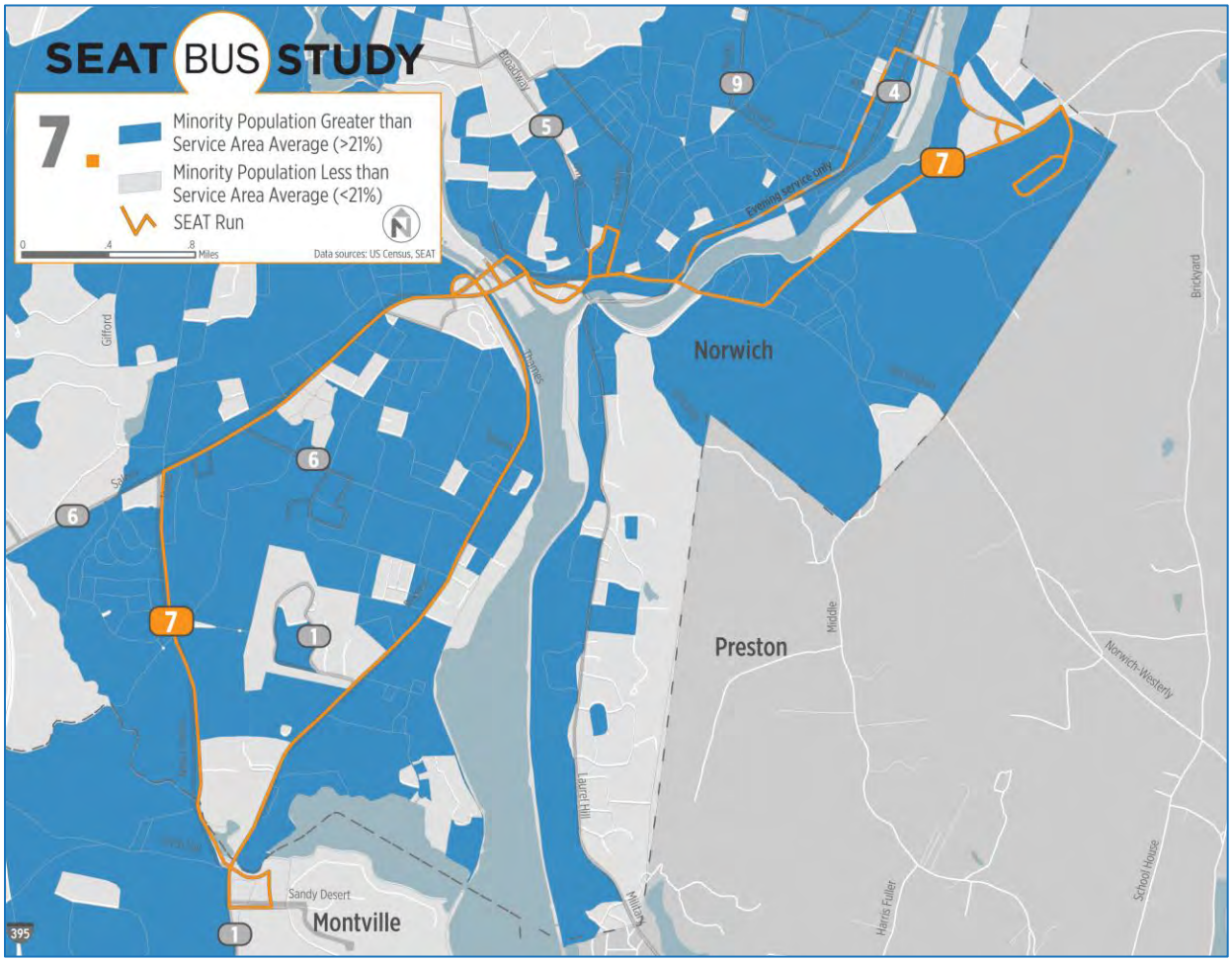
Most Census blocks in the central parts of Norwich have a higher percentage of minority population compared to the region as a whole. Consequently, most of Run 7's alignment serves higher proportions of minority populations compared to other runs. In total, 41% of the Census blocks that Run 7 serves contain higher number of minority population.

FIGURE 12 – SERVICE TO BLOCKS WITH HIGH MINORITY POPULATIONS



Sources: US Census 2010, SEAT

FIGURE 13 – MAP OF BLOCKS WITH HIGH MINORITY POPULATIONS



Sources: US Census 2010, SEAT

SERVICE IMPROVEMENT OPTIONS

Run 7 is a top performing run with high ridership and service to a number of important regional activity centers such as Three Rivers Community College and Mohegan Sun Casino. Although the run performs well and is productive, it has a very complicated service schedule and alignment. In addition, there are a number of deviations or trip variants that contribute little ridership activity and add complexity to the service. Accordingly, there a number of options to simplify service and focus resources on the most productive market for Run 7:

- **Separate Into two runs.** The two parts of Run 7 serve unique and distinct markets. Separating the run into two runs and having both start and end at Norwich Transportation would allow for more flexibility with future alignment and schedule changes. Interlining between the two could still be possible with a shorter run time.
- **Operate Mohegan Sun service via West Main Street in both directions.** Providing bidirectional service along West Main Street would provide more direct service to Three Rivers Community College without having to do significant backtracking via Mohegan Sun. This would improve the attractiveness of service to the entire college community for travel between the college and Norwich and the rest of the SEAT system. In addition, Run 1/101 already provides service on West Thames Street, so this segment would continue to have excellent service.
- **Operate on the east side of the river only.** East of the Norwich Transportation Center, Run 7 makes a complicated loop alignment during the evenings and could be consolidated to serve only the east side of the river. Run 9 and Run 4 could continue to serve the west side of the river. This would give each run a unique area to serve and provide much more simple and easy to use service for riders.
- **Discontinue Franklin Street deviation in downtown Norwich.** Currently Run 7 deviates to serve Franklin Street, Willow Street, and Chestnut Street, however this deviation only carries two riders per day. This forces the overwhelming majority of passengers to ride around in a loop and increasing their through travel time. Operating directly on Main Street would provide faster service for nearly all passengers and shorten travel times.
- **Discontinue Quarto Road loop.** Run 7 uses an eastern terminal loop along Quarto Road and Donahue Drive, though few riders board and alight along the loop and it could be discontinued. Instead, buses could turn around at Hamilton and Long Society Road, by the Hamilton Avenue Playground. This would shorten the run and allow additional flexibility in scheduling.
- **Begin the evening service pattern later.** Currently Run 9 operates until 9:00 PM, providing service on Boswell Avenue, Hickory Street, and North Main Street. There is some overlap of service areas between the two lines. Having the evening service pattern for Run 7 begin later would reduce service duplication between both lines.
- **Operate a single service pattern all day every day.** Run 9 has a complicated service pattern, with a night and Sunday variant that has a unique alignment along Central Avenue. The unique segment of this variant carries very few riders and only adds complexity to the service. Run 7 could operate a single service pattern all day, every day, which would go a long way to simplifying service and making it easier for riders to understand and use.
- **Provide evening service on the southern portion of the run only.** Ridership on Run 7 is low during the evening, but is focused primarily on the southern portion of the run (to and from Mohegan Sun). Truncating the service at downtown Norwich would focus resources on the most productive segment of the run.

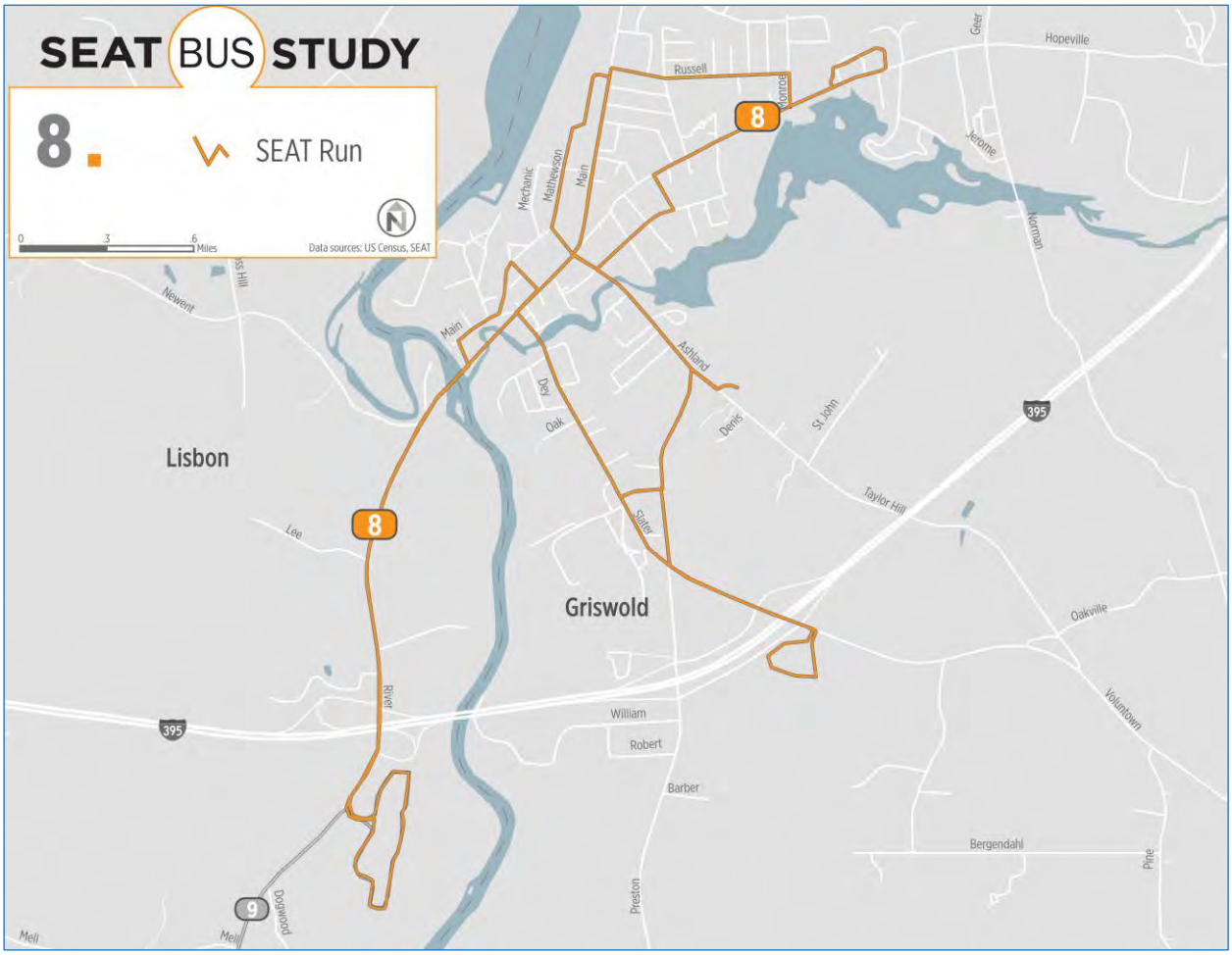
SERVICE EVALUATION

RUN 8 (JEWETT CITY / LISBON LANDING / LISBON CROSSING)

Service Design. Run 8 is a coverage-focused run that operates in Lisbon, Griswold, and Jewett City. The run alignment is complex and circuitous, featuring several one-way loops and backtracking.

The run begins at Lisbon Landing and circulates through the shopping center before proceeding north on River Road (Route 12). Once entering Jewett City, the run deviates onto K of C Drive, South Main Street, Railroad Avenue, and Soule Street before rejoining Main Street in the center of Jewett City. The run then makes a loop via North Main Street and returning on Aspinook Street and Matthewson Street before starting another loop via Ashland Street to serve two subsidized apartment complexes on Taylor Hill Road and Pleasant View Street, looping back to central Jewett City on Ann Street and Slater Avenue. A third loop begins to serve the north side of Jewett City. The run heads north on North Main Street, Russell Street, and Monroe Street before turning around at Indian Ridge Apartments and returning southbound

FIGURE 1 - RUN MAP



on East Main until Hawkins Street, where the run deviates to serve the Jewett City Playground and the Veterans Memorial Park. A final loop operates on segments that already served previously by the run. The run operates southbound via Ashland Street then on Pleasant Hill Road, however does not pull into the apartments on Taylor Hill Road. Unlike the last time this section was served, this time, the run continues further south on Highway Route 138 to the Ocean State Job Lot, just south of I-395. The run then returns to central Jewett City on Slater Avenue before returning back to Lisbon Landing on River Road.

The first and last trips of the day also continue to Norwich Transportation Center, which would otherwise be a deadhead trip between the bus depot and the beginning of Run 8.

Service Schedule. Despite the complexity of Run 8's alignment, the schedule is fairly simple. Run 8 operates every hour from 6:00 AM until 8:25 PM on weekdays and Saturdays. The numerous turns, backtracking, and deviations however, may make it more difficult for passengers to figure out when the bus will hit various time points. The first and last trips of the day also serve Norwich Transportation Center.

FIGURE 2 – SCHEDULE STATISTICS

Service Day	Span of Service	Frequency (min) Peak / Off-Peak	Daily Trips
Weekday	6:00 AM — 8:25 PM	60	30
Saturday	6:00 AM — 8:25 PM	60	30
Sunday	-	-	-

Source: SEAT Run Schedules

Interaction with System. Run 8 is fairly isolated in Jewett City and Lisbon. At Lisbon Landing, timed connections are available to Run 9 for continuing service to the Norwich Transportation Center.

Run 8 only serves the Norwich Transportation Center on its first and last trip. The first and last trips, however, serve Norwich Transportation Center in the early morning and the late evening when most other runs are not operating. The final trip, however, does provide a timed connection to Run 1/101 for service to New London.

Ridership by Service Day. Run 8 is less productive than most runs in the SEAT system. On weekdays, the run carries 138 riders, an average of just under 5 riders per trip (see Figures 3 through 5). This is well below the system average of 13.0 riders per trip. On Saturdays, ridership is lower than on weekdays with 87 riders, or an average of just 2.9 riders per trip. This is also well below the system average of 9.5 riders.

FIGURE 3 – RIDERSHIP STATISTICS

Service Day	Daily Ridership	Ridership per Trip	
	Run 8	**Run 8**	**System Avg**
Weekday	138	4.6	13.0
Saturday	87	2.9	9.5
Sunday	-	-	5.8

SEAT Ridecheck 2014

FIGURE 4 – AVERAGE WEEKDAY RIDERSHIP

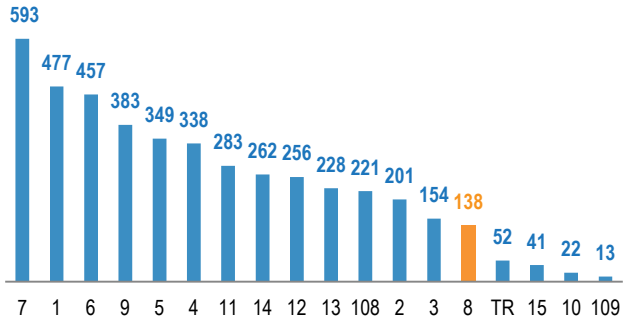
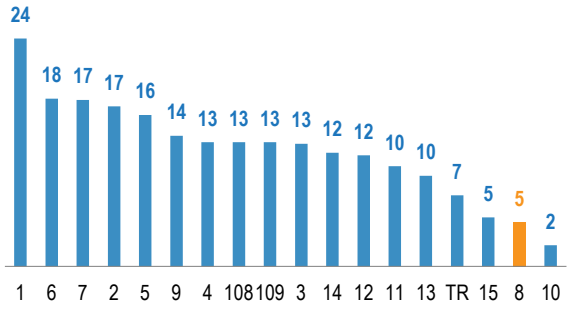


FIGURE 5 – AVERAGE WEEKDAY RIDERSHIP PER TRIP



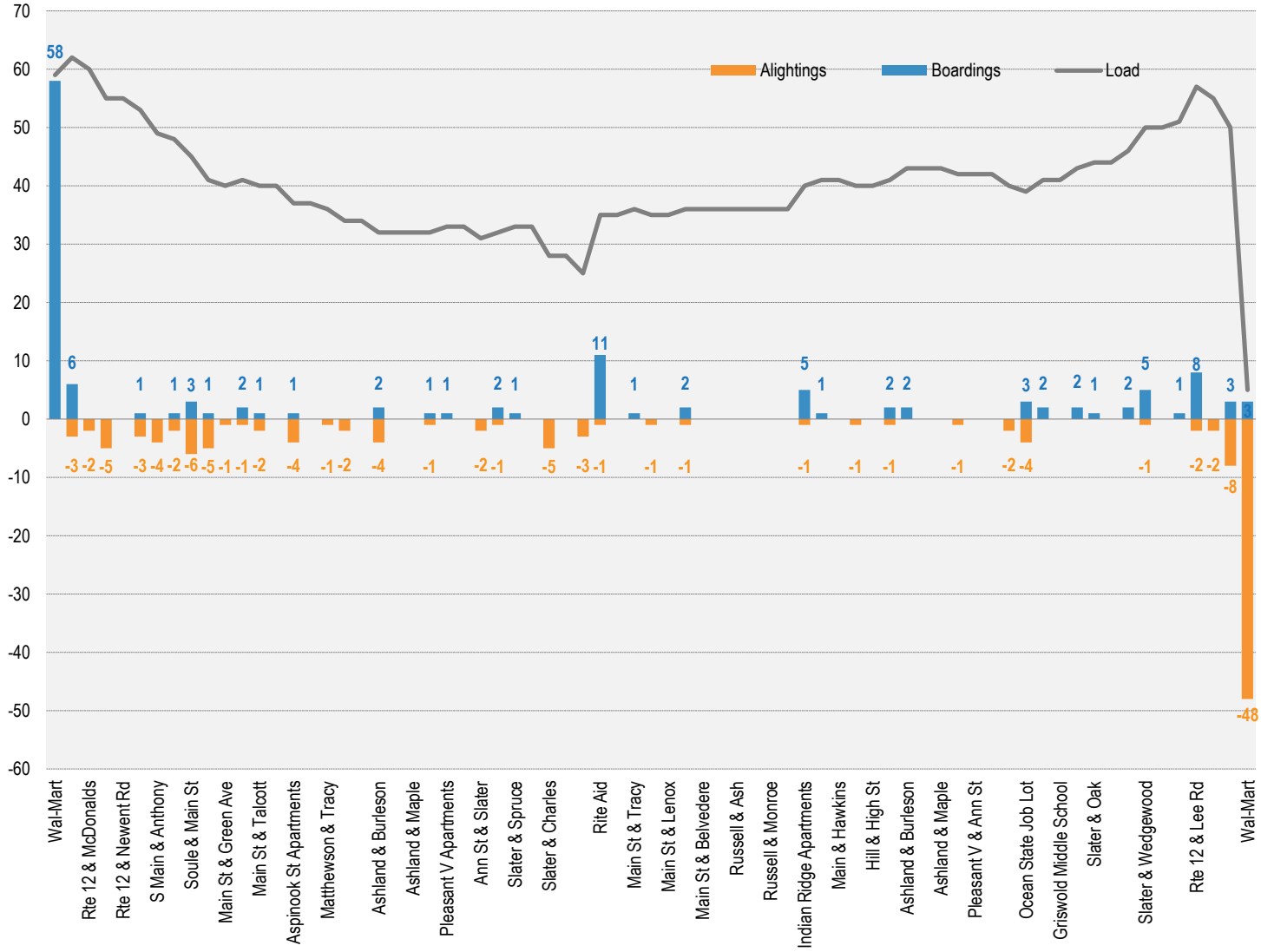
Source: SEAT Ridecheck 2014

Ridership by Stop. Ridership on Run 8 is primarily between the Lisbon Landing shopping center and various local destinations in Jewett City, evidenced by the high activity at Lisbon Landing and distributed activity elsewhere. The load profile suggests that the first half of the run is largely for dropping off, with total load decreasing. As the run begins to repeat on segments that it has already served, the second half has significantly more boardings and fewer alightings and the load increases.

Lisbon Landing is by far the highest ridership stop on the run with 58 daily boardings and 48 alightings at Wal-Mart and a total of 12 boardings and 11 alightings at Target. Other stops have significantly less ridership, with only a handful of riders boarding each day. Areas of higher ridership activity include:

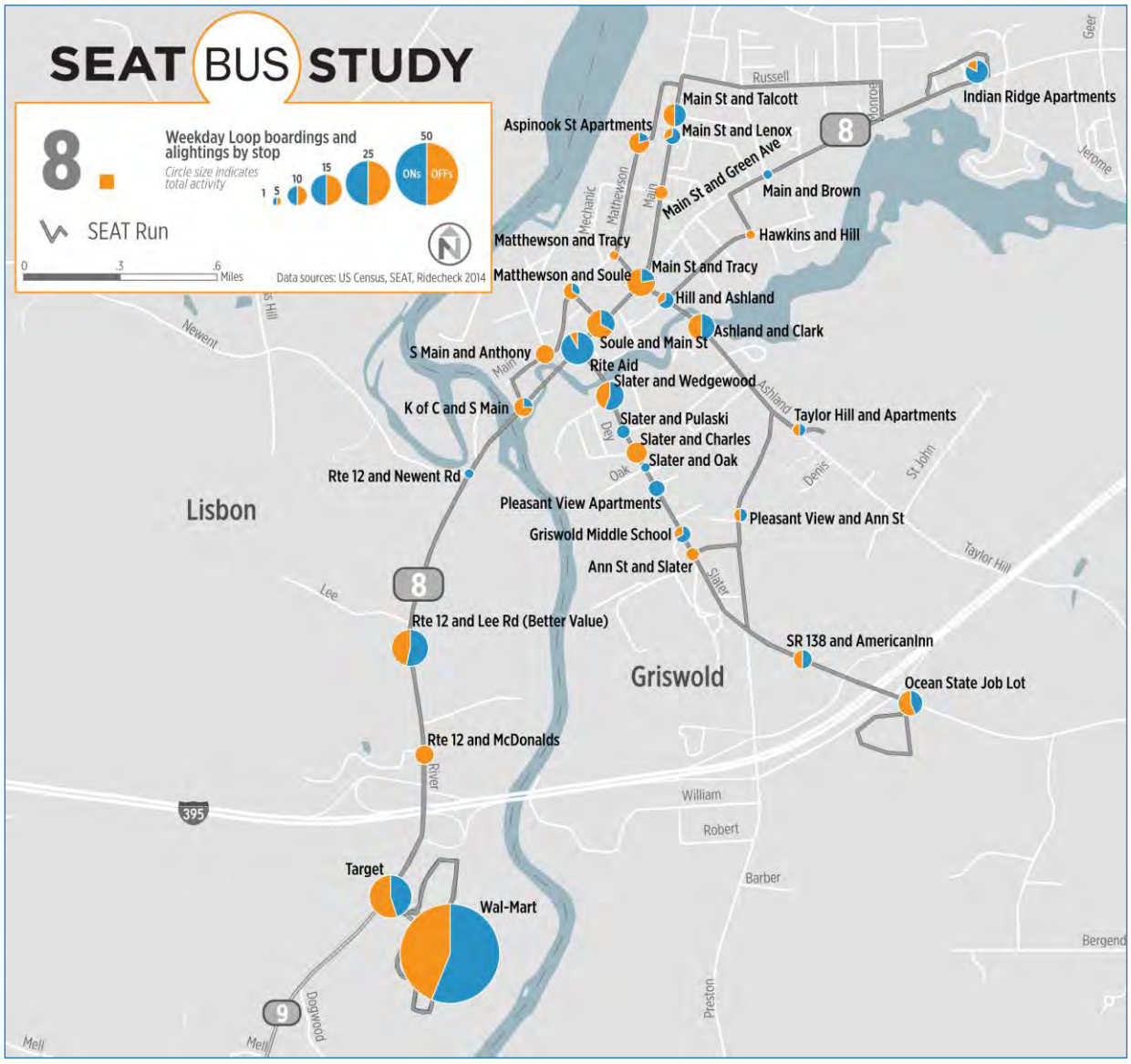
- **Rite Aid on Main Street (Jewett City).** This stop has 11 boardings per day on the second time passing through downtown Jewett City.
- **Route 12 and Lee Road.** This stop has a total of 12 boardings and 7 alightings.
- **Main Street at Soule Street and Tracey Avenue**. These two stops are where Run 8 reaches downtown Jewett City for the first time. The Soule Street stop has 6 daily alightings and 3 boardings, and the Tracy Avenue stop has 5 alightings and 1 boarding.
- **Indian Ridge Apartments** has 5 boardings and 1 alighting. The difference in boardings and alightings could be attributed to the fact that passengers accessing to the Indian Ridge Apartments would have to ride through several loops before arriving and could be disembarking earlier in the run.
- **Slater and Wedgewood** has a total of 5 boardings and a 4 alightings. This stop is close to the repurposed Slater Mill, which now houses several commercial uses.
- **Ocean State Job Lot** has 3 boardings and 4 alightings each day.

FIGURE 6 – LOOP RIDERSHIP BY STOP CHART



Source: SEAT Ridecheck 2014

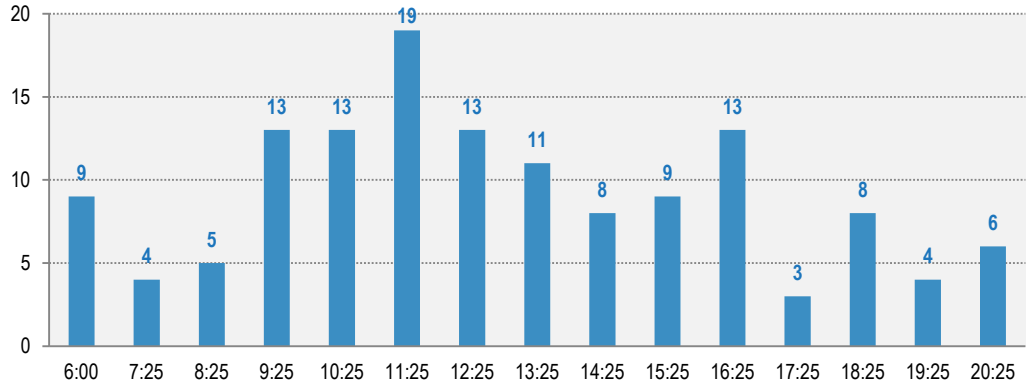
FIGURE 7 – LOOP WEEKDAY RIDERSHIP BY STOP MAP



Source: SEAT Ridecheck 2014

Ridership by Trip. Run 8 has strong midday ridership, indicating the run serves a strong all-day demand for various trip types (see Figure 8). Ridership activity per trip peaks with 19 riders on the 11:25 AM trip. For the most part, ridership increases until this midday trip, followed by a decline in ridership on subsequent trips. An additional smaller peak in ridership occurs at 4:25 PM with 13 boardings, however other trips have less ridership. There are also some trips with very few riders staggered throughout the day, including the 7:25 AM trip with 4 riders and the 5:25 PM trip with 3 riders.

FIGURE 8 – LOOP PASSENGERS PER TRIP



Source: SEAT Ridecheck 2014

Performance. Overall, Run 8 is one of the lowest performing runs on all measures (see Figures 9 through 11). The number of passengers per revenue hour is 8.6 on weekdays and 5.4 on Saturdays, which is less than half of the systemwide averages of 20.9 and 16.4 respectively. Consequently, Run 8 ranks the third least productive run in the network. This is partially due to the current run design where the number of repeated or similar segments causes riders to disembark on the first time an area is served, and then board on the second time it is served. If boardings and alightings could be consolidated into a single trip, the run would be much more productive.

The operational speed is also fairly slow at 13.7 miles per hour due to the use of local streets, a high number of turning movements, and internal circulation around shopping centers. On-time performance is slightly below the systemwide average, at 49.6% on weekdays and 50.4% on Saturdays.

FIGURE 9 – PERFORMANCE MEASURES

Performance Measure	Weekday		Saturday		Sunday	
	Run 8	System Avg	Run 8	System Avg	Run 8	System Avg
Passengers per Revenue Vehicle Hour	8.6	20.9	5.4	16.4	-	12.9
Passengers per Revenue Vehicle Mile	0.6	1.6	0.4	1.2	-	0.8
Average Speed (mph)	13.7	16.2	13.7	15.2	-	17.6
On-Time Performance Reliability*	49.6%	57.9%	50.4%	52.8%	-	40.8%

*On-Time Performance is the percent of sampled observations where the bus arrived at timepoints within 5 minutes of the scheduled time.
Source: SEAT Analysis Factors 2014

FIGURE 10 – WEEKDAY RIDERS PER REVENUE HOUR

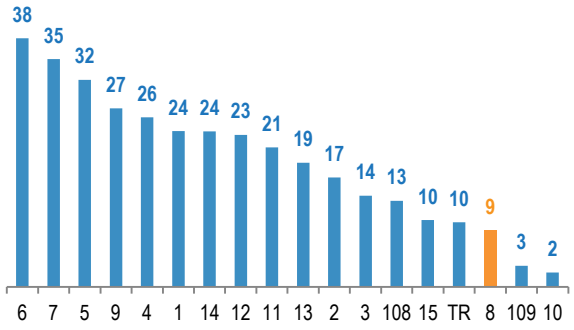
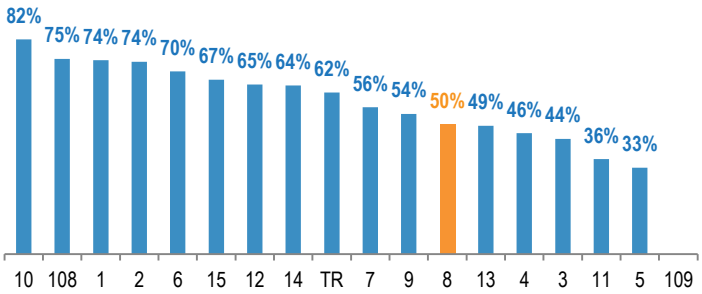


FIGURE 11 – WEEKDAY ON-TIME PERFORMANCE

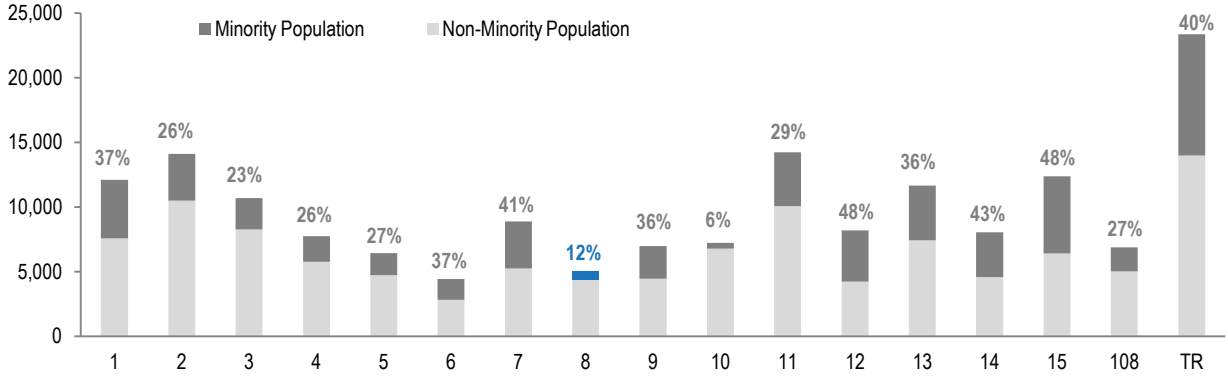


Source: SEAT Ridecheck 2014

Environmental Justice

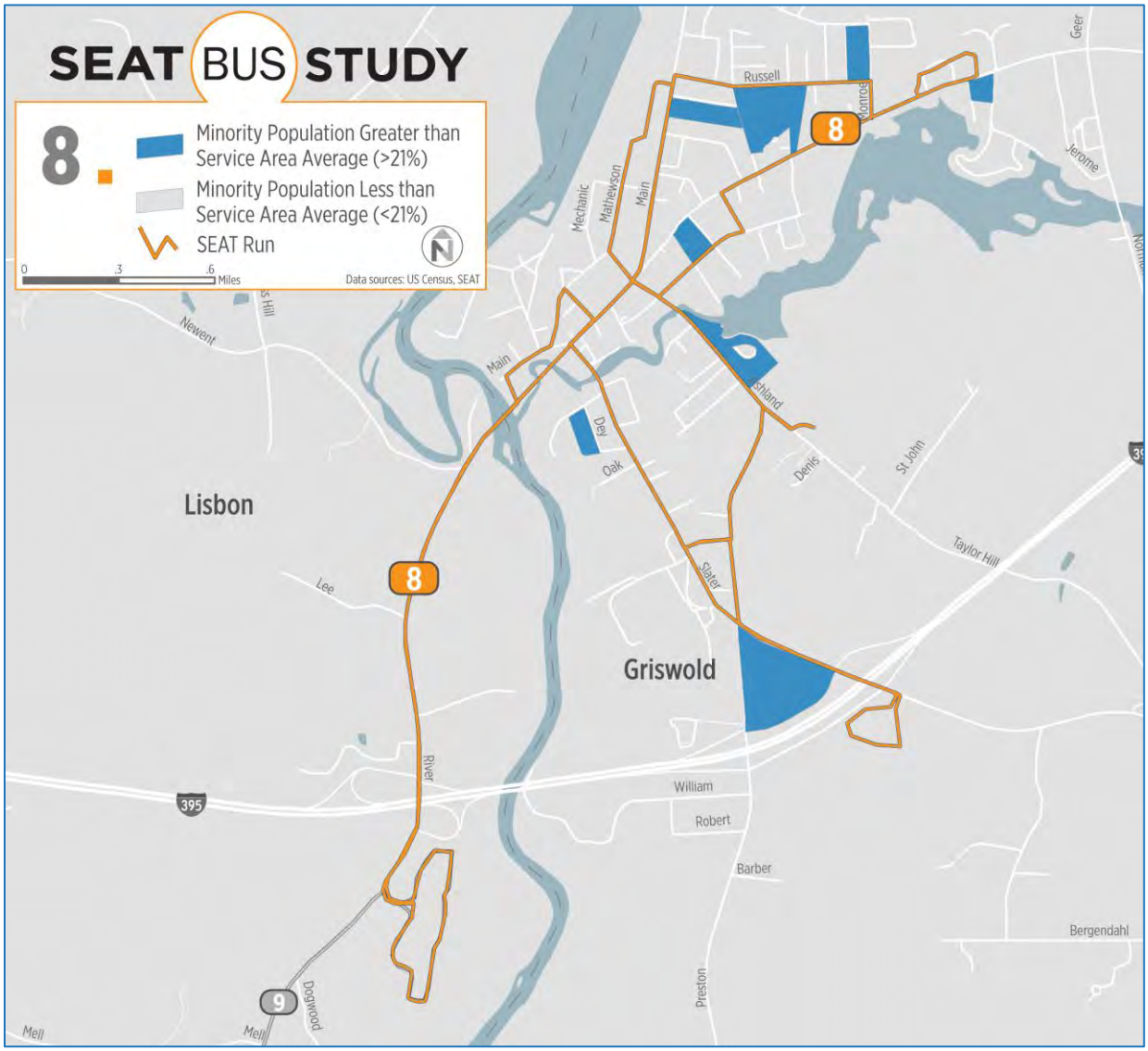
Run 8's service area has 12% of Census blocks having minority population greater than the service area average. This is fewer than nearly all runs in the SEAT bus system. Specific areas along the run with higher concentrations of minority population include near Ashland Street south of Veterans Memorial Park, along Russell Street in the northern part of Jewett City, and in Griswold north of I-395 (however, this block itself has very low total population to begin with).

FIGURE 12 – SERVICE TO BLOCKS WITH HIGH MINORITY POPULATIONS



Sources: US Census 2010, SEAT

FIGURE 13 – MAP OF BLOCKS WITH HIGH MINORITY POPULATIONS



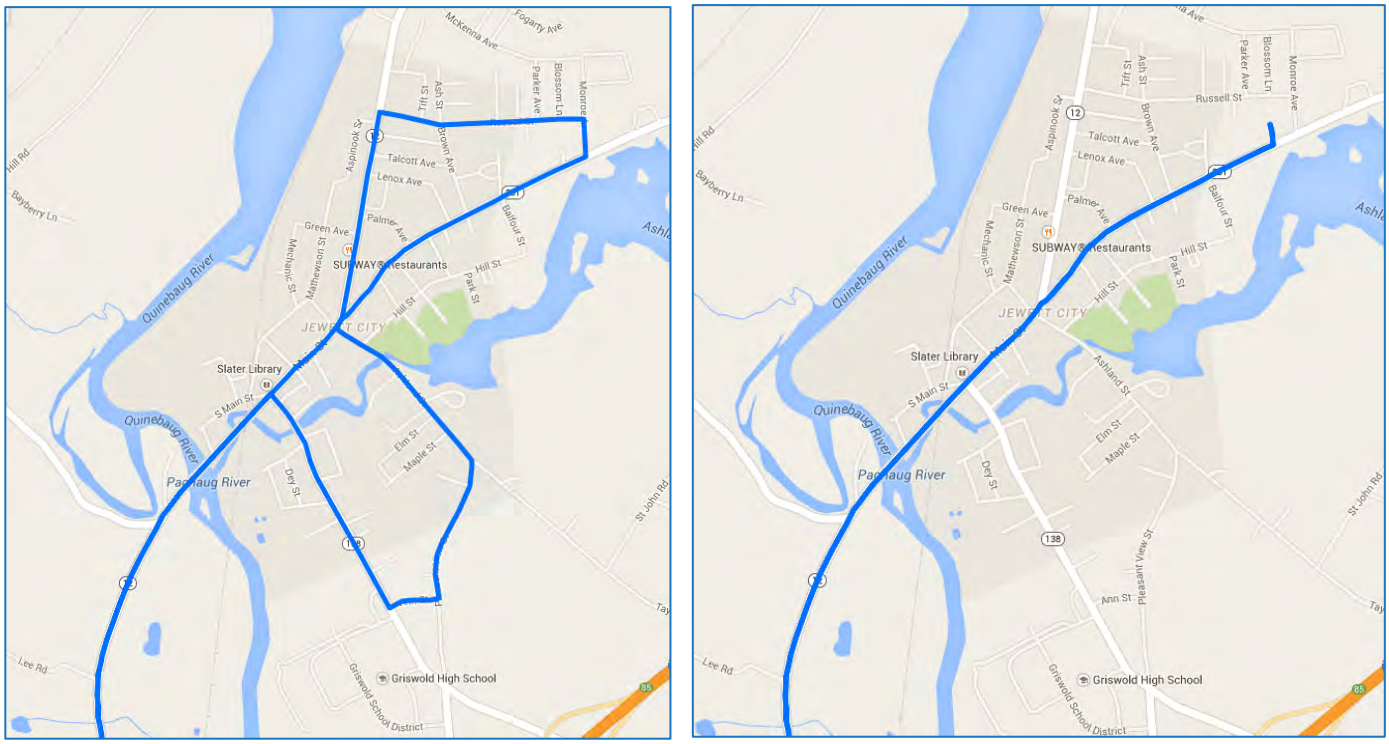
Sources: US Census 2010, SEAT

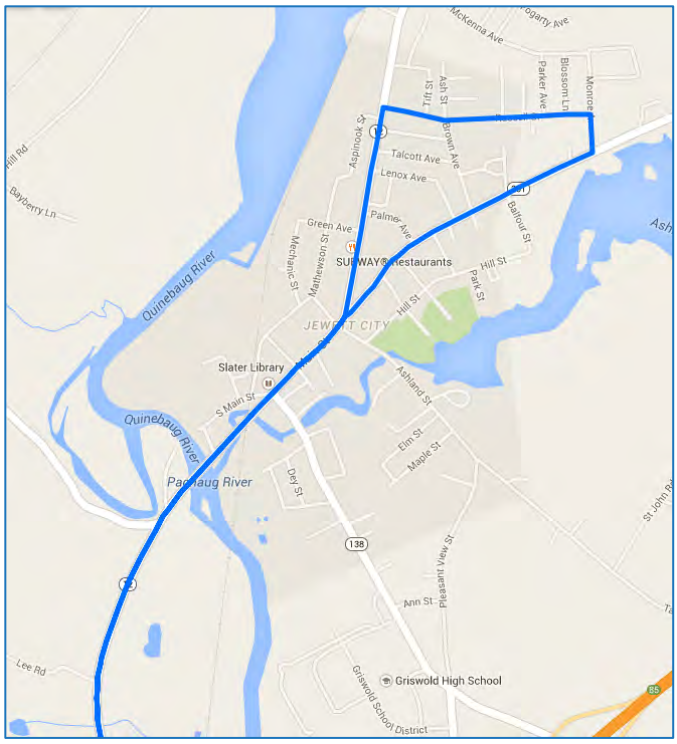
SERVICE IMPROVEMENT OPTIONS

Run 8 is a bottom performer in the SEAT system and falls below nearly all performance metrics, particularly due to the complexity of its alignment, numerous loops, and the fact that some loops are repeated several times. Ridership on the run is low as a result of the low demand from the Jewett City market and also the run's service design. However, Run 8 could be simplified and improved to provide faster and more attractive service for the residents and workers of Jewett City and nearby communities. Options to improve service include:

- **Consolidate with Run 9.** Run 9 provides service between Norwich and Lisbon Landing, connecting with Run 8 but forcing a transfer for riders traveling between Norwich and Jewett City. Both runs could be consolidated in order to offer a one-seat ride between Norwich and Jewett City.
- **Re-align deadheading trips to Run 9.** The first and last trips of the day follow a similar alignment to that of Run 9. However, there are some minor differences in Norwich. Re-aligning the service to follow Run 9 and signing the service as Run 9 would reduce any confusion about where these first and last trips are going and improve simplicity of Run 8's schedule.
- **Operate Run 8 as a flex service.** The low-density environment of Jewett City as well as the large coverage area indicates the potential for a flex service. Flex service deviates off of the fixed alignment to serve areas that do not have the density to support fixed transit but still have a need for transit. Fixed timepoints along a run would allow for regularity of such services.
- **Simplify the alignment in Jewett City.** The numerous loops in Run 8's alignment require that passengers ride through a circuitous alignment before accessing their stop, and it also makes the run more difficult to understand and use (particularly for discretionary transit riders who have low tolerance for transit). The alignment could be simplified a number of ways, but three potential options are shown in Figure 14.

FIGURE 14 – POTENTIAL ALIGNMENT OPTIONS FOR RUN 8



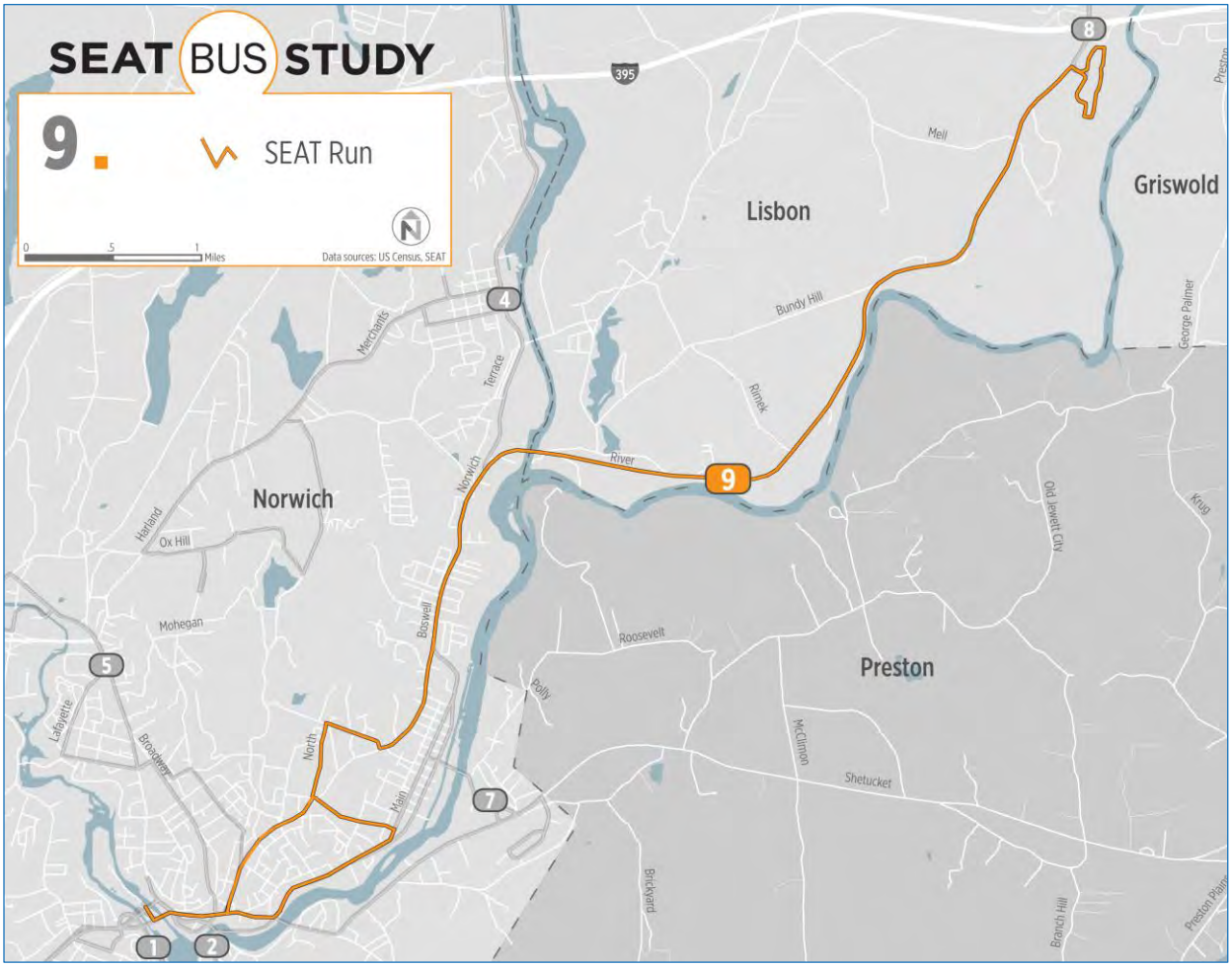

McKenna Ave
Ash St
Parker Ave
Talcott Ave
Lenox Ave
Aspinook St
Brown Ave
Green Ave
Palmer Ave
Balfour St
Mechanic St
Matthewson St
SUBWAY® Restaurants
Hill St
Park St
Quinebaug River
Slater Library
S Main St
Ashland St
Elm St
Maple St
Pachaug River
Dell St
138
Pleasant View St
Ann St
Griswold High School
Griswold School District
Lee Rd
Barberry Ln

SERVICE EVALUATION

RUN 9 (NORWICH / LISBON LANDING / ROUTE 12)

Service Design. Run 9 operates between Norwich Transportation Center and Lisbon Landing, a major shopping complex in Lisbon. The run for the most part is direct, primarily operating on River Road, Norwich Avenue, Boswell Avenue, and North Street. However, once in Norwich, the run splits into two one-way alignments depending on the direction. In the southbound direction, service turns east from Boswell Avenue onto Hickory Street, then southbound on Central Avenue, circulating in central Norwich on North Main Street, Water Street, Westside Boulevard, and then entering the Norwich Transportation Center on West Main Street. Northbound, the run operates on West Main Street, Chelsea Harbor Drive, Franklin Street, and Boswell Avenue before rejoining the unified section of the run.

FIGURE 1 – RUN MAP



Service Schedule. Run 9 has a fairly simple schedule, operating every hour from 7:00 AM to 9:00 PM (see Figure 2). Like most local runs, Run 9 provides service on weekdays and Saturdays. There is no Sunday service.

FIGURE 2 – SCHEDULE STATISTICS

Service Day	Span of Service	Frequency (min) Peak / Off-Peak	Daily Trips
Weekday	7:00 AM — 9:00 PM	60	28
Saturday	7:00 AM — 9:00 PM	60	28
Sunday	-	-	-

Source: SEAT Run Schedules

Interaction with System. Run 9 provides service to the Norwich Transportation Center, which provides connections to other local and regional destinations. In addition, Run 9 interacts with other lines:

- Run 4 provides bidirectional parallel service on North Main Street every hour.
- Run 7 provides parallel one-way southbound service on Central Avenue and North Main Street in Norwich every hour.
- Run 8 provides onward connections from Lisbon Landing to local destinations in Jewett City. Transfers are timed at Lisbon Landing.

Ridership by Service Day. Run 9 is the fourth busiest run in the SEAT network, with 383 weekday riders, or an average of 13.7 passengers per trip (see Figures 3 through 5). However, due to the long hours of service and higher number of trips compared to the rest of the system, Run 9's ridership per trip is just slightly higher than the systemwide average of 13.0 riders. On Saturdays, ridership is 28% less than on weekdays with 261 boardings, or an average of 9.3 per trip. Likewise, this is slightly below the systemwide average due to the longer span of service.

FIGURE 3 – RIDERSHIP STATISTICS

Service Day	Daily Ridership	Ridership per Trip	
	Run 9	**Run 9**	**System Avg**
Weekday	383	13.7	13.0
Saturday	261	9.3	9.5
Sunday	-	-	5.8

Source: SEAT Ridecheck 2014

FIGURE 4 – AVERAGE WEEKDAY RIDERSHIP

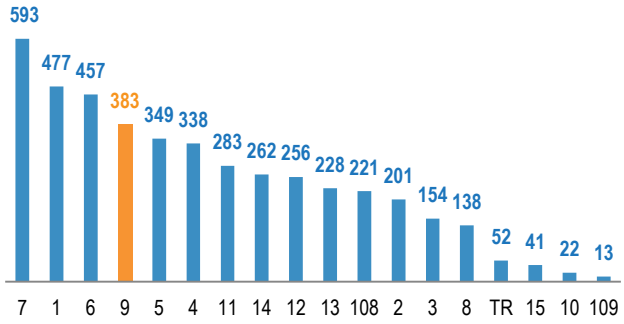
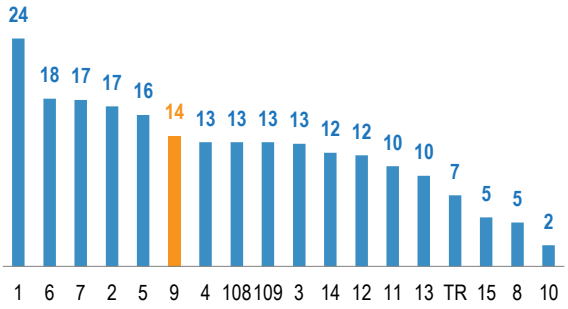


FIGURE 5 – AVERAGE WEEKDAY RIDERSHIP PER TRIP

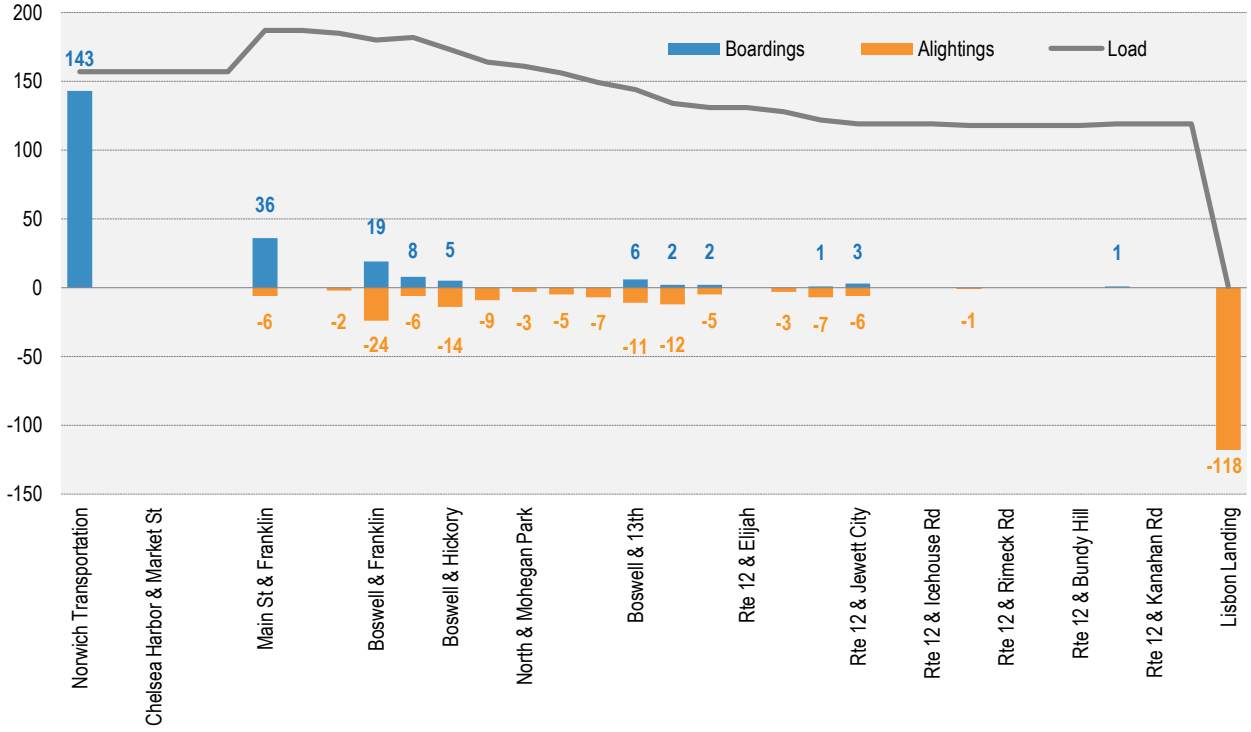


Source: SEAT Ridecheck 2014

Ridership by Stop. Ridership on Run 9 is primarily between the two ends of the run, Norwich Transportation Center and Lisbon Landing. The strong activity at the endpoints is evidence of the run's primary market serving riders for travel between Norwich and Lisbon Landing and likely connecting onward to Jewett City. Other areas have significantly less ridership. Stops with comparatively high ridership are as follows:

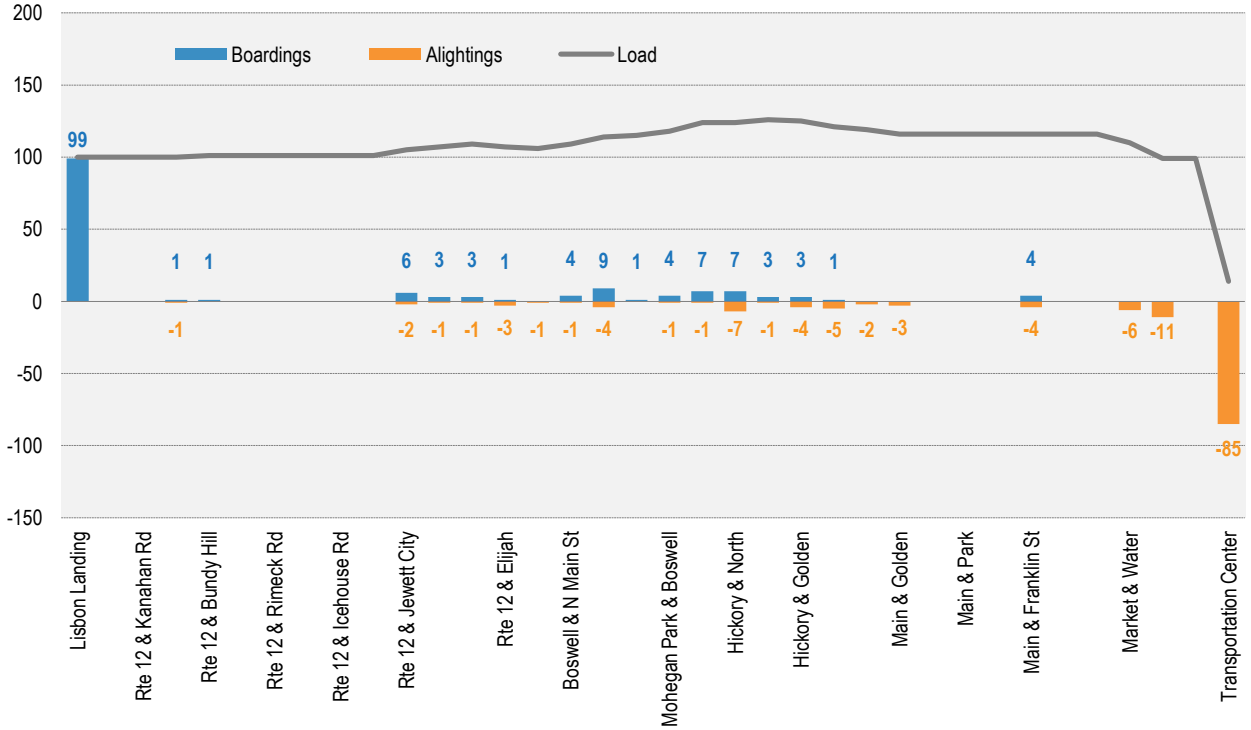
- **Norwich Transportation Center.** There are 143 boardings at Norwich Transportation Center. 14 passengers stay onboard, most likely due to the one-way alignments south of Hickory Street in Norwich.
- **Lisbon Landing.** There are 118 alightings at Lisbon Landing, evidence of a strong market for travel between Jewett City and Norwich.
- **Franklin Street at Main Street.** This stop in central Norwich experiences 36 boardings and 6 alightings in the northbound direction.
- **Boswell Avenue and Franklin Street** is only served in the northbound direction, and has 19 boardings and 24 alightings.
- **Boswell Avenue and North Street.** Although ridership is fairly dispersed across the entire length of this street, there is noticeable ridership activity when considered as a whole. Between Franklin Street and North Main Street, there is a total of 23 boardings and 67 alightings across all stops in the northbound direction. Southbound, between North Main Street and Hickory Street, there is a total of 25 boardings and 7 alightings.

FIGURE 6 – NORTHBOUND WEEKDAY RIDERSHIP BY STOP CHART



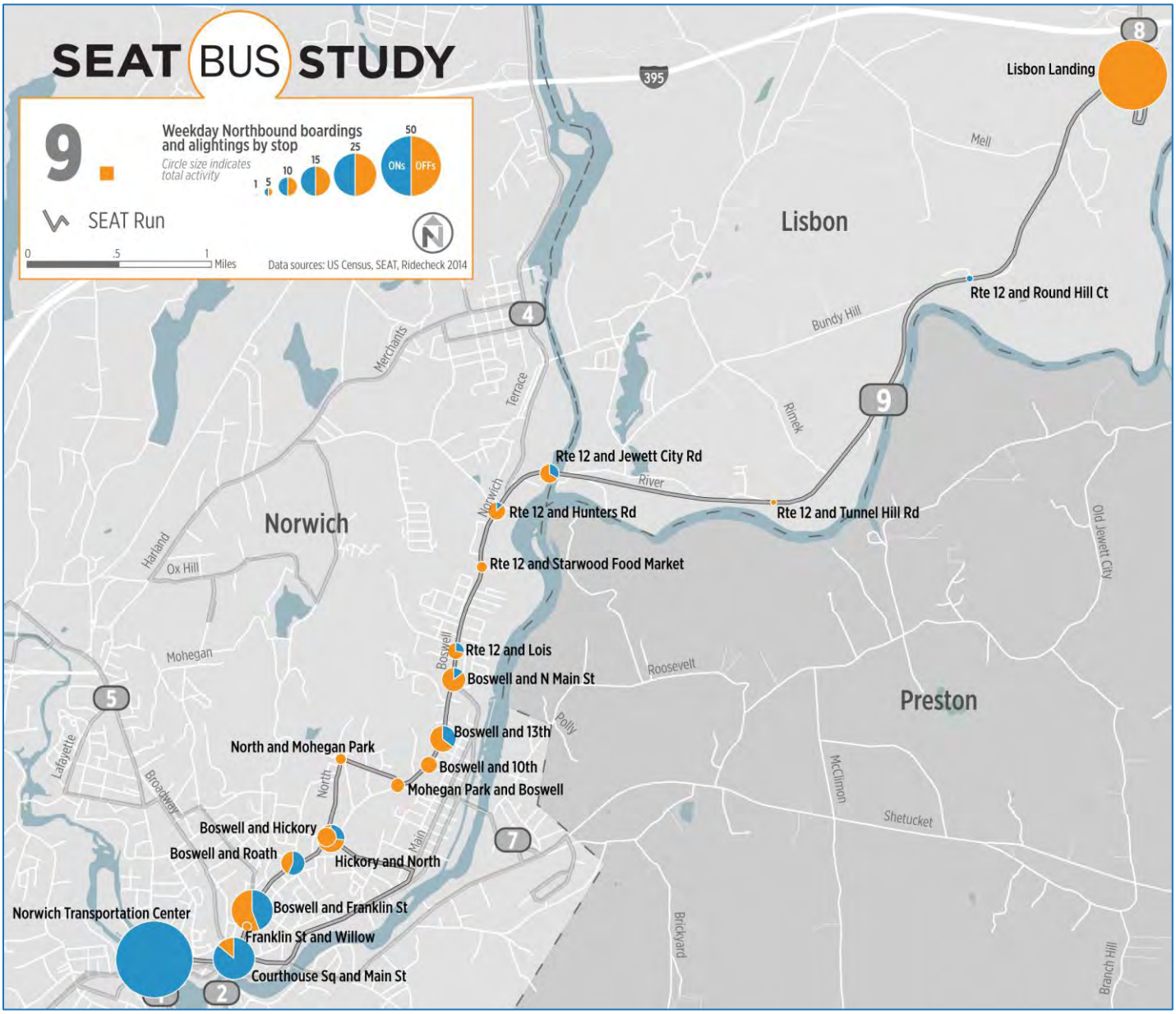
Source: SEAT Ridecheck 2014

FIGURE 7 – SOUTHBOUND WEEKDAY RIDERSHIP BY STOP CHART



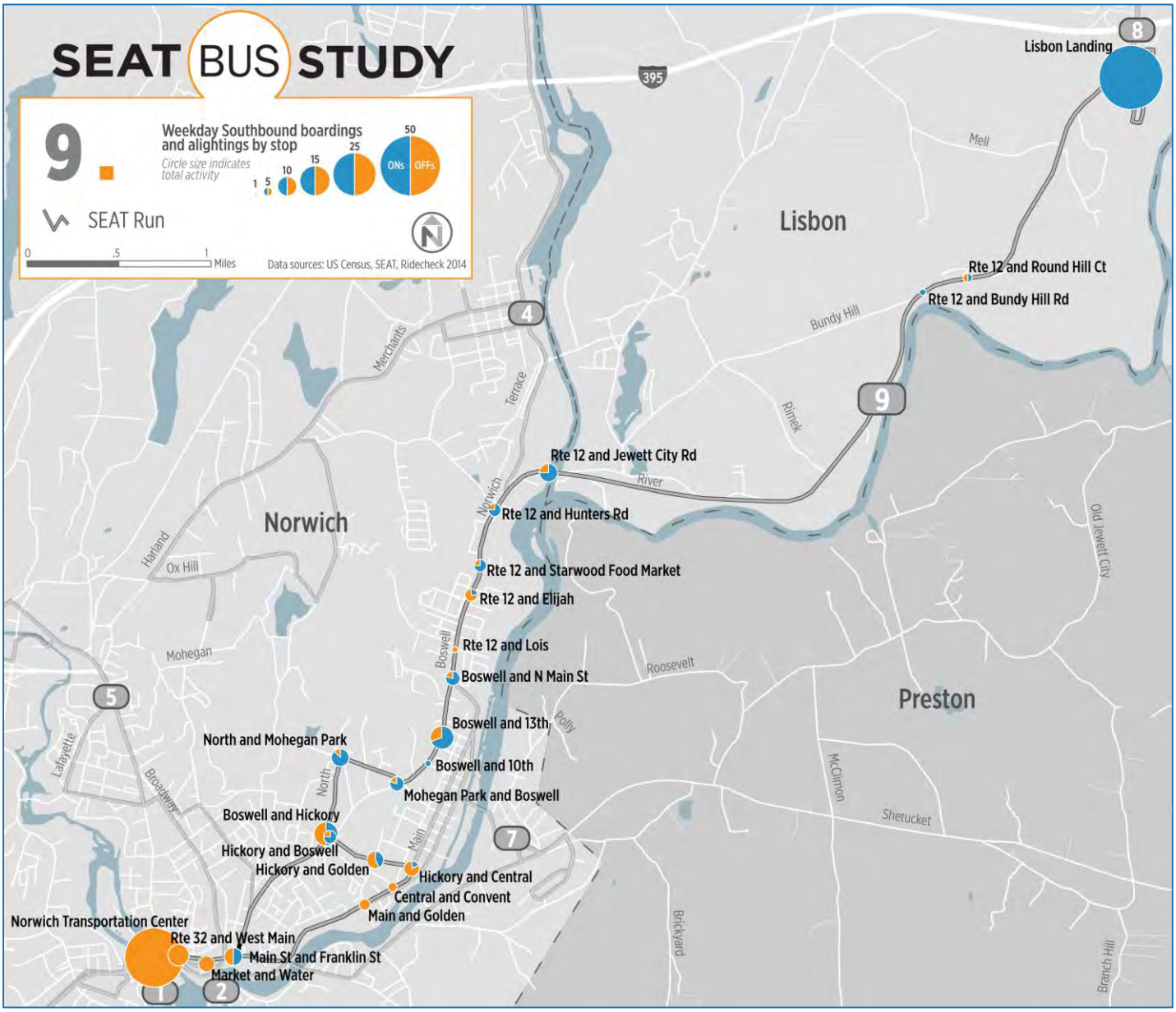
Source: SEAT Ridecheck 2014

FIGURE 8 – NORTHBOUND WEEKDAY RIDERSHIP BY STOP MAP



Source: SEAT Ridecheck 2014

FIGURE 9 – SOUTHBOUND WEEKDAY RIDERSHIP BY STOP MAP



Source: SEAT Ridecheck 2014

Ridership by Trip. Ridership on Run 9 does not follow the traditional peak/off-peak ridership pattern, which suggests a strong demand for all-day service for a variety of trip types. Instead, ridership is highest during the early afternoon. This suggests that passengers are primarily using the service to access the shopping centers during business hours and/or to access employment shifts during non-traditional hours. In the northbound direction towards Lisbon Landing, service begins at 7:00 AM with only nine riders, decreasing slightly to six at 9:00 AM before increasing significantly. The 2:00 PM is the busiest trip with 38 riders, although subsequent trips carry far fewer passengers before another peak in ridership at 5:00 PM with 32 riders. Evening trips have fewer riders than during the day with the last 8:00 PM trip only carrying four passengers. The southbound direction also sees similar pattern with the highest ridership in the midday. Service begins at 7:25 AM and generally increases until a peak in ridership at 1:25 PM with 23 passengers. All subsequent trips carry 13 riders or less.

FIGURE 10 – NORTHBOUND WEEKDAY RIDERS PER TRIP

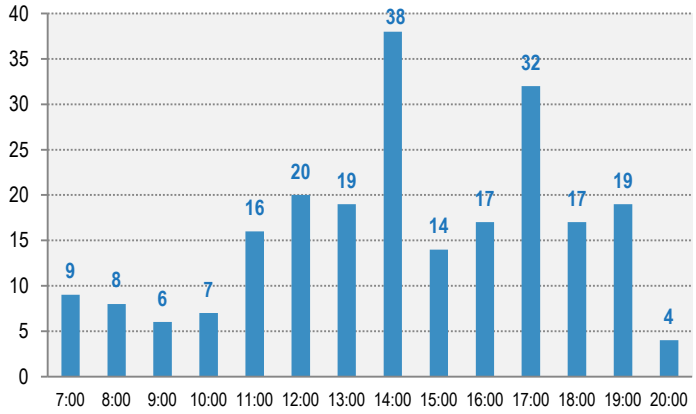
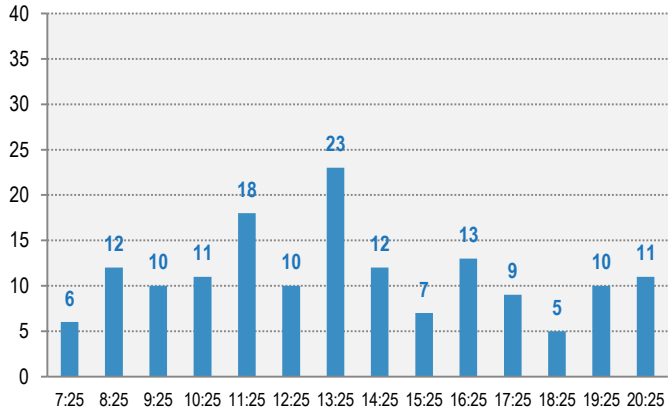


FIGURE 11 – SOUTHBOUND WEEKDAY RIDERS PER TRIP



Source: SEAT Ridecheck 2014

Performance. Overall, Run 9 performs above average in most performance metrics, partially due to its mostly direct alignment and strong anchors at both ends of the line (see Figures 12 through 14). Consequently, Run 9 is the fourth most productive run in the system. Its weekday ridership per revenue hour at 27.4 is higher than the systemwide average of 20.9. Saturday ridership per hour is 18.6, also higher than the system average of 16.4. The operational speed of Run 9 is faster than most line due to the few turns in the run and use of main thoroughfares.

Despite high ridership productivity, Run 9 performs below average in terms of on-time performance. Only 53.6% of weekday trips arrive on time. Thus, revisions in alignments and scheduling are needed in order to provide more reliable service.

FIGURE 12 – PERFORMANCE MEASURES

Performance Measure	Weekday		Saturday		Sunday	
	Run 9	System Avg	Run 9	System Avg	Run 9	System Avg
Passengers per Revenue Vehicle Hour	27.4	20.9	18.6	16.4	-	12.9
Passengers per Revenue Vehicle Mile	1.5	1.6	1.0	1.2	-	0.8
Average Speed (mph)	18.0	16.2	18.0	15.2		17.6
On-Time Performance Reliability*	53.6%	57.9%	68.0%	52.8%	-	40.8%

*On-Time Performance is the percent of sampled observations where the bus arrived at timepoints within 5 minutes of the scheduled time.
Source: SEAT Analysis Factors 2014

FIGURE 13 – WEEKDAY RIDERS PER REVENUE HOUR

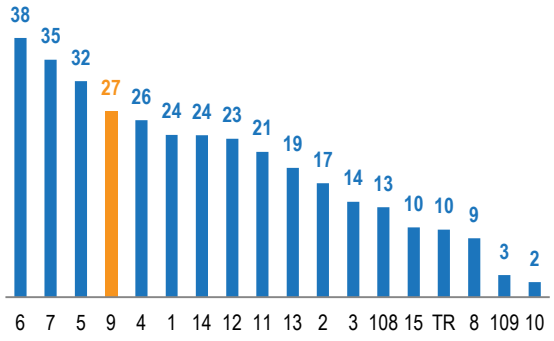
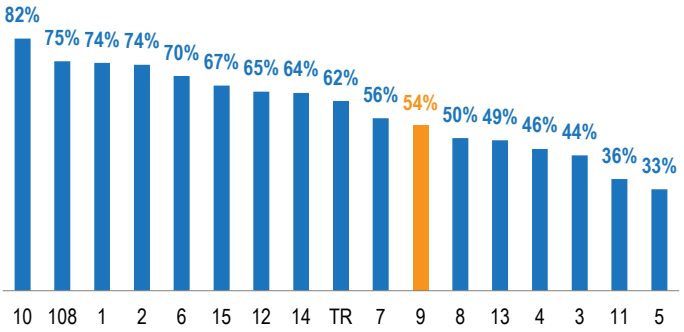


FIGURE 14 – WEEKDAY ON-TIME PERFORMANCE



Source: SEAT Ridecheck 2014

Environmental Justice

Run 9 predominately serves areas with a slightly higher minority population than is found in the SEAT service area overall. Over one third (36%) of the population served by Run 9 lives in census blocks that have a minority population greater than the overall service area average (21%). As shown in Figure 16, these minority populations are concentrated along the portion of the run located in Norwich, with no high-minority tracts located along the Lisbon portion of the run.

FIGURE 15 – SERVICE TO BLOCKS WITH HIGH MINORITY POPULATIONS

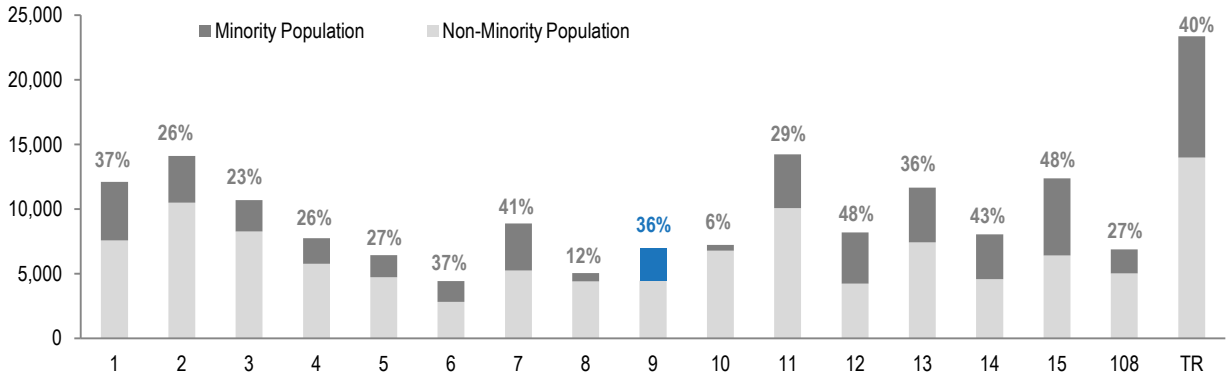
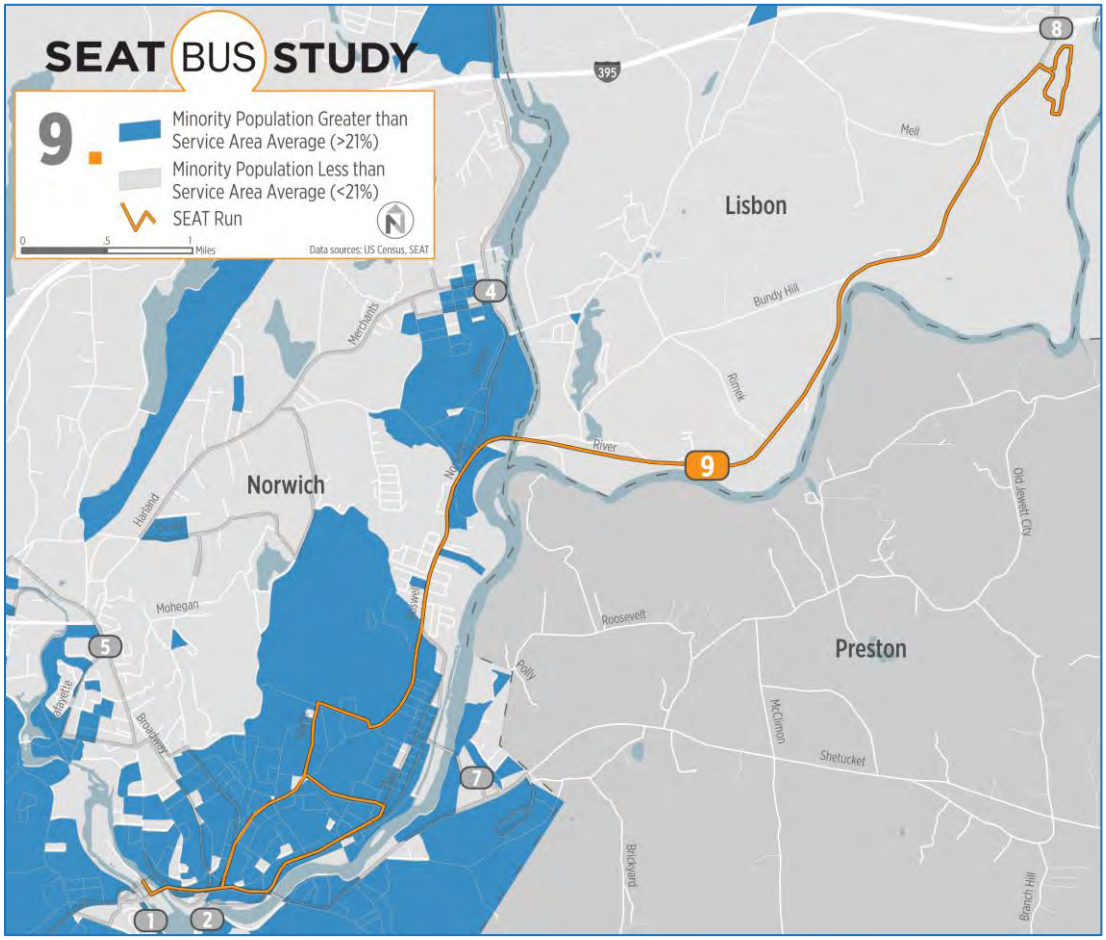


FIGURE 16 – MAP OF BLOCKS WITH HIGH MINORITY POPULATIONS



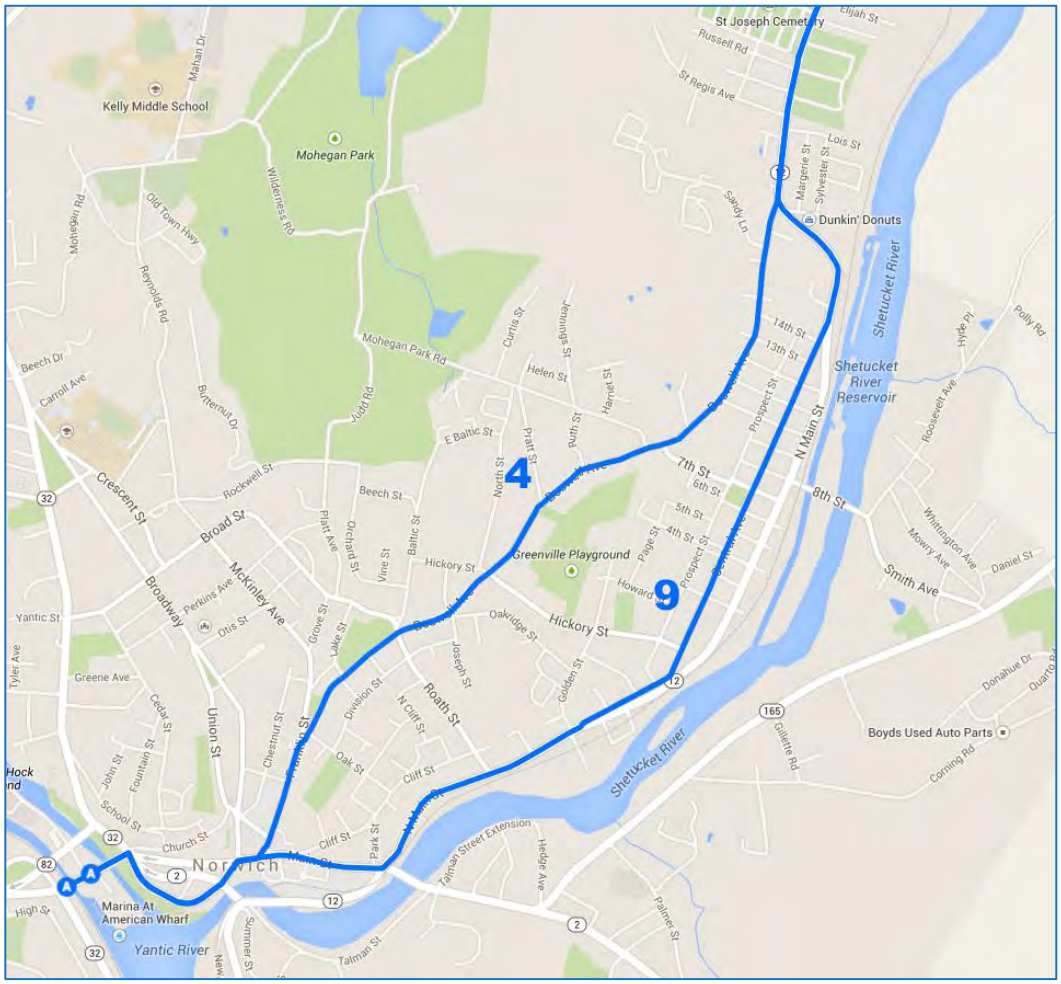
Sources: US Census 2010, SEAT

SERVICE IMPROVEMENT OPTIONS

Run 9 is a relatively productive run and provides an important link between Norwich and Lisbon, with connecting service to Jewett City. Its service design is simple for the most part, easy to remember, and provides service to major anchors such as downtown Norwich and Lisbon Landing. In order to further improve this run, the following options should be considered:

- **Consolidate with Run 8.** As evidenced by the high volume of activity at Lisbon Landing, there is likely demand for connecting service between Norwich and Jewett City. Run 8 and Run 9 could be consolidated into a single run in order to provide a one-seat ride for these riders. Consolidated service would improve the attractiveness of transit service for travel between Norwich and Jewett City, particularly for time-sensitive riders and those with a lower tolerance for transit.
- **Realign Norwich service to Central Avenue.** Run 9 currently provides service along North Main Street and Franklin Street/Boswell Avenue in Norwich, which dilutes service into less ideal one-way pairs and duplicates service provided by Run 4. Both runs could be realigned to serve distinct and unique markets. For example, Run 4 could be realigned to serve Franklin Street and Boswell Avenue through Norwich, and Run 9 could be realigned to serve Central Avenue only. Such realignment would give each run a unique market that would better spread service through downtown Norwich (see Figure 17).

FIGURE 17 – EXAMPLE REALIGNMENT OF RUNS 4 AND 9 THROUGH NORWICH



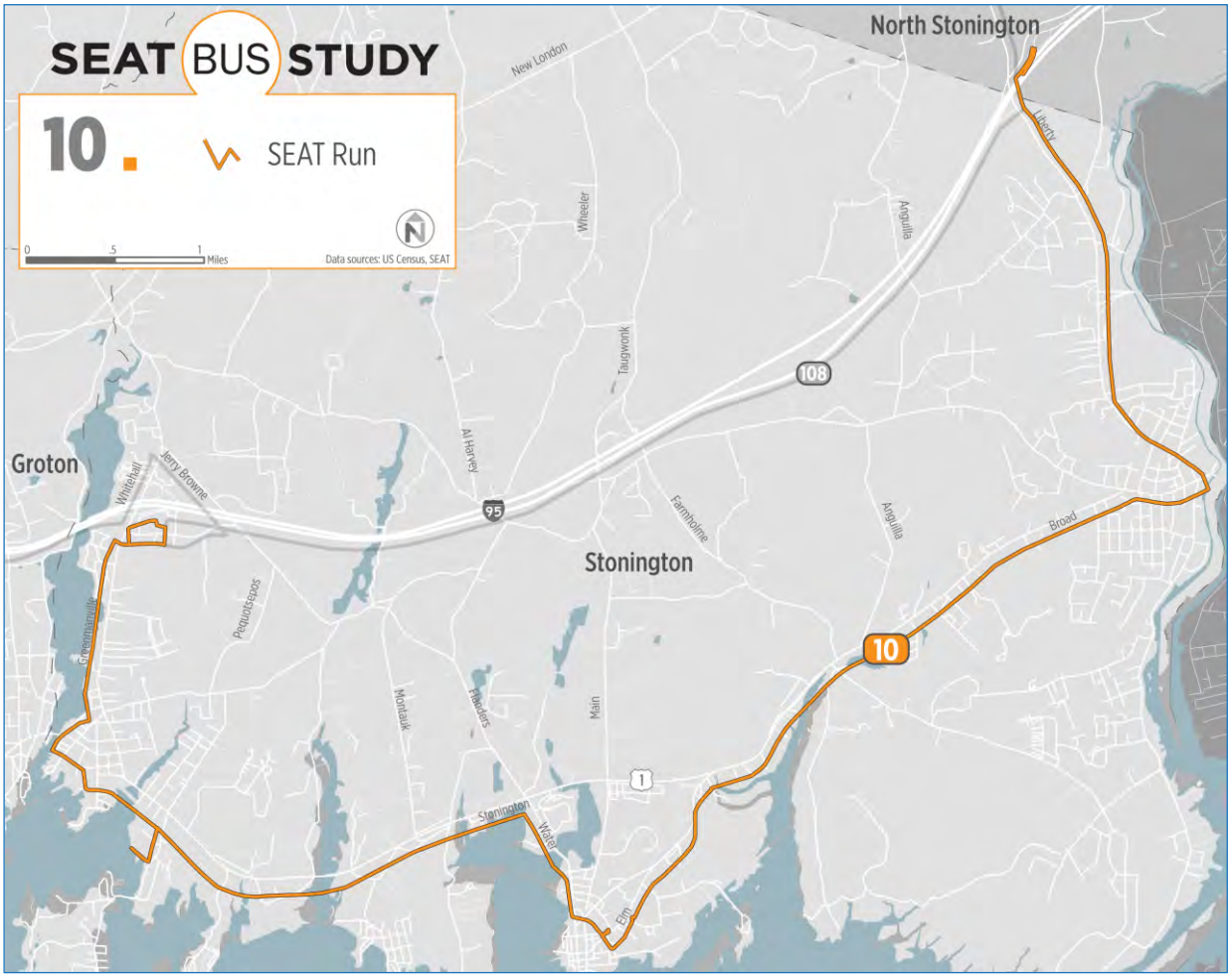
- **Revise Public Information.** The current map suggests an alignment that is quite different from the streets listed on the timetable or the ridechecks performed on this run. Updating the map on SEAT's website would avoid any confusion about the run's alignment.
- **Serve both sides of Lisbon Landing.** Run 9 currently serves the south side of Lisbon Landing shopping center, but could also serve the north side to provide service to Target, Aldi, and Lowe's. The two sides of the shopping center are not easily traversable, which effectively cuts off the northern side of the center from service. Run 9 could also serve the north side without adding too much time to the schedule.

SERVICE EVALUATION

RUN 10 (PAWCATUCK / MYSTIC)

Service Design. Run 10 operates in a large U-shaped pattern from Olde Mistick Village Shopping Center in Mystic to a Park-and-Ride lot at I-95 in Pawcatuck. The run primarily operates along Highway Route 27 (Whitehall Avenue, Greenmanville Avenue), Highway Route 1 (Stonington Westerly Road, South Broad Street), and Liberty Street, connecting several communities along the run.

FIGURE 1 – RUN MAP



Service Schedule. Run 10 has a simple and predictable schedule, operating every two hours on weekdays from 7:15 AM to 5:13 PM. There is no service on weekends or holidays.

FIGURE 2 – SCHEDULE STATISTICS

Service Day	Span of Service	Frequency (min) Peak / Off-Peak	Daily Trips
Weekday	7:15 AM — 5:13 PM	120	10
Saturday	-	-	-
Sunday	-	-	-

Source: SEAT Run Schedules

Interaction with System. Run 10's alignment is fairly isolated compared to the rest of the system and only interacts with one other SEAT run, Run 108, at two locations:

- At Olde Mistick Village Shopping Center (Run 10's western terminus), connections can theoretically be made to Run 108 for continuing service to New London or Foxwoods Resort Casino. The schedules, however, do not line up, and therefore would cause excessive wait times, limiting the potential for such a connection.
- At the I-95 Park-n-Ride in North Stonington, connections can also theoretically be made between Run 10 and Run 108 for service to Foxwoods Resort Casino or New London. However, connections may require long wait times. There are also no indications on the public schedules to advertise this connection as an option.

Run 10 also provides service to the Mystic Amtrak station, which provides intercity connections along the Northeast Corridor line towards Boston or Washington, DC.

Finally, Run 10 operates near the Rhode Island border, just a half-mile walk to the Westerly Amtrak station. The Rhode Island Public Transit Authority (RIPTA) Route 95X operates peak hour service from this Amtrak station to Providence, RI. Route 95X provides three AM trips to Providence and three PM trips from Providence.

Ridership by Service Day. Run 10 carries few riders and has the second lowest ridership per day and the lowest average ridership per trip compared to the rest of the system (see Figures 3 and 4). On average, only 22 passengers per day use the service, with 10 daily trips carrying an average of just 2.2 passengers per trip. This is far below the 13.0 passengers per trip average of the entire system (see Figure 5).

FIGURE 3 – RIDERSHIP STATISTICS

Service Day	Daily Ridership		Ridership per Trip
	Run 10	**Run 10**	**System Avg**
Weekday	22	2.2	15.0
Saturday	-	-	11.2
Sunday	-	-	7.5

Source: SEAT Ridecheck 2014

FIGURE 4 – AVERAGE WEEKDAY RIDERSHIP

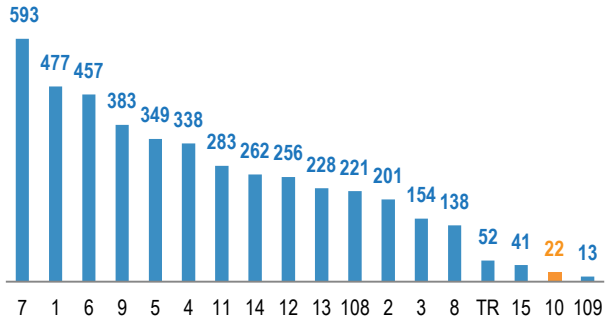
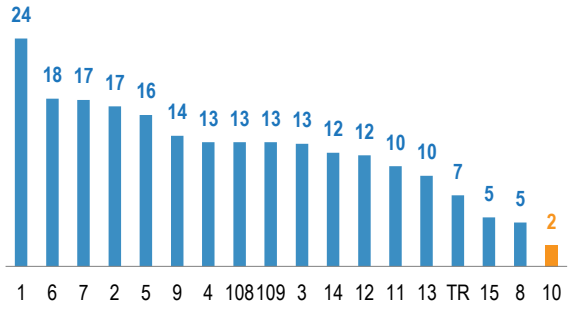


FIGURE 5 – AVERAGE WEEKDAY RIDERSHIP PER TRIP



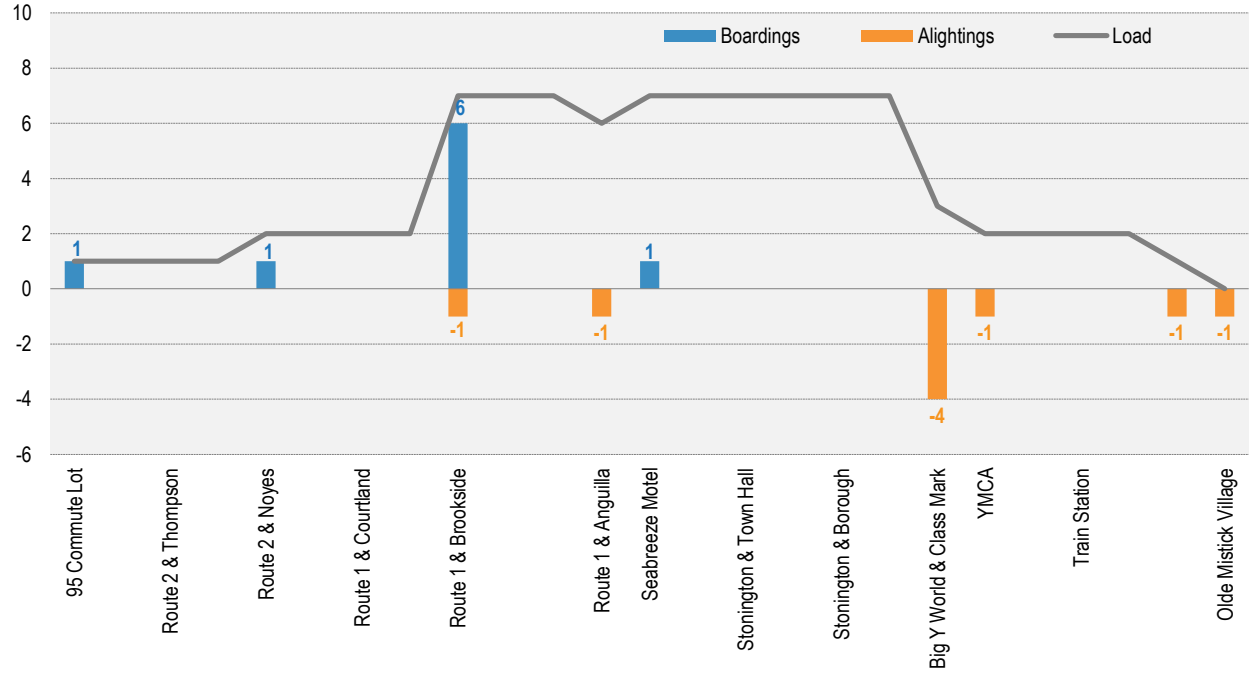
Source: SEAT Ridecheck 2014

Ridership by Stop. Ridership is very low on Run 10, which makes it difficult to accurately discern areas of activity (see Figure 8). However the data does indicate some trends in ridership activity:

- **Route 1 (South Broad St) & Brookside Lane in Pawcatuck**. This stop has six westbound passengers per day, far above any other stop. This area serves a Section 8 apartment complex, suggesting a higher number of transit-dependent individuals. This stop also has five alightings in the eastbound direction.
- **Big Y on Route 1 (Stonington Westerly Road) in Mystic** has four westbound alightings and four eastbound boardings (most likely the same people doing the roundtrip).

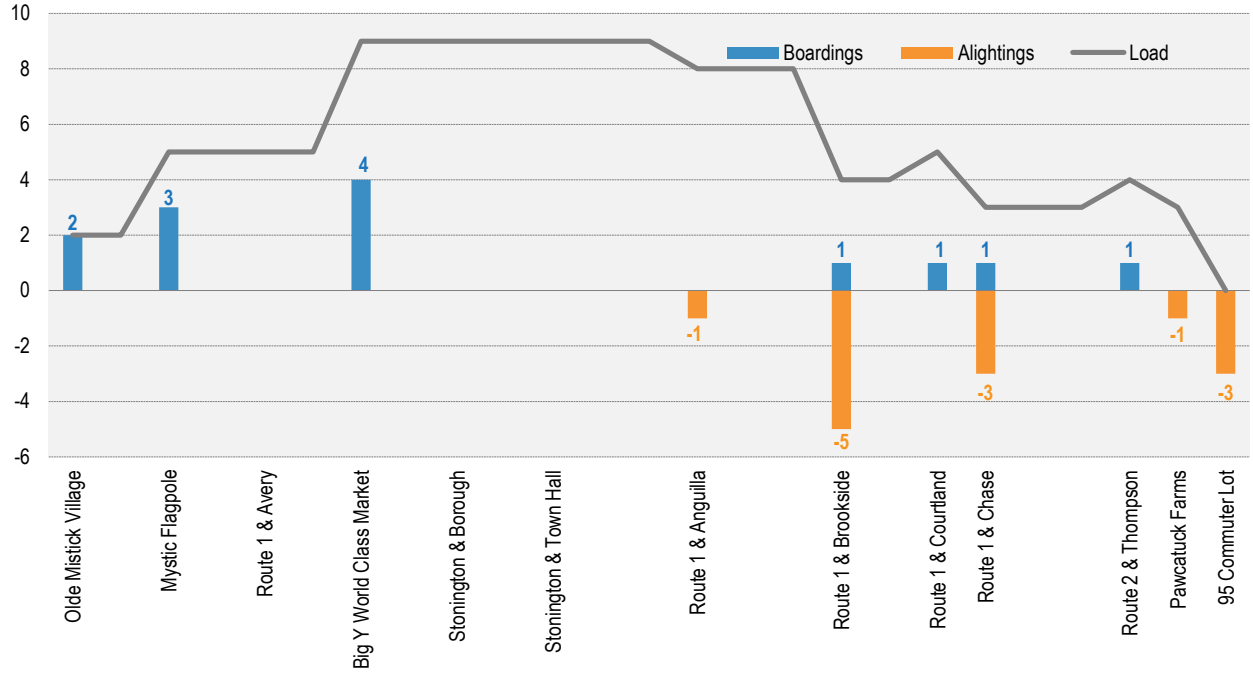
All other areas serve very few riders per day. The ridership patterns suggest that the primary market for this run are residents of the Brookside Village Apartments in Pawcatuck, who use the service to access the supermarket and other essential services. Brookside Village Apartments is a Section 8 eligible apartment complex, indicating a transit-dependent population.

FIGURE 6 – WESTBOUND WEEKDAY RIDERSHIP BY STOP CHART



Source: SEAT Ridecheck 2014

FIGURE 7 – EASTBOUND WEEKDAY RIDERSHIP BY STOP CHART



Source: SEAT Ridecheck 2014

FIGURE 8 – WESTBOUND WEEKDAY RIDERSHIP BY STOP MAP

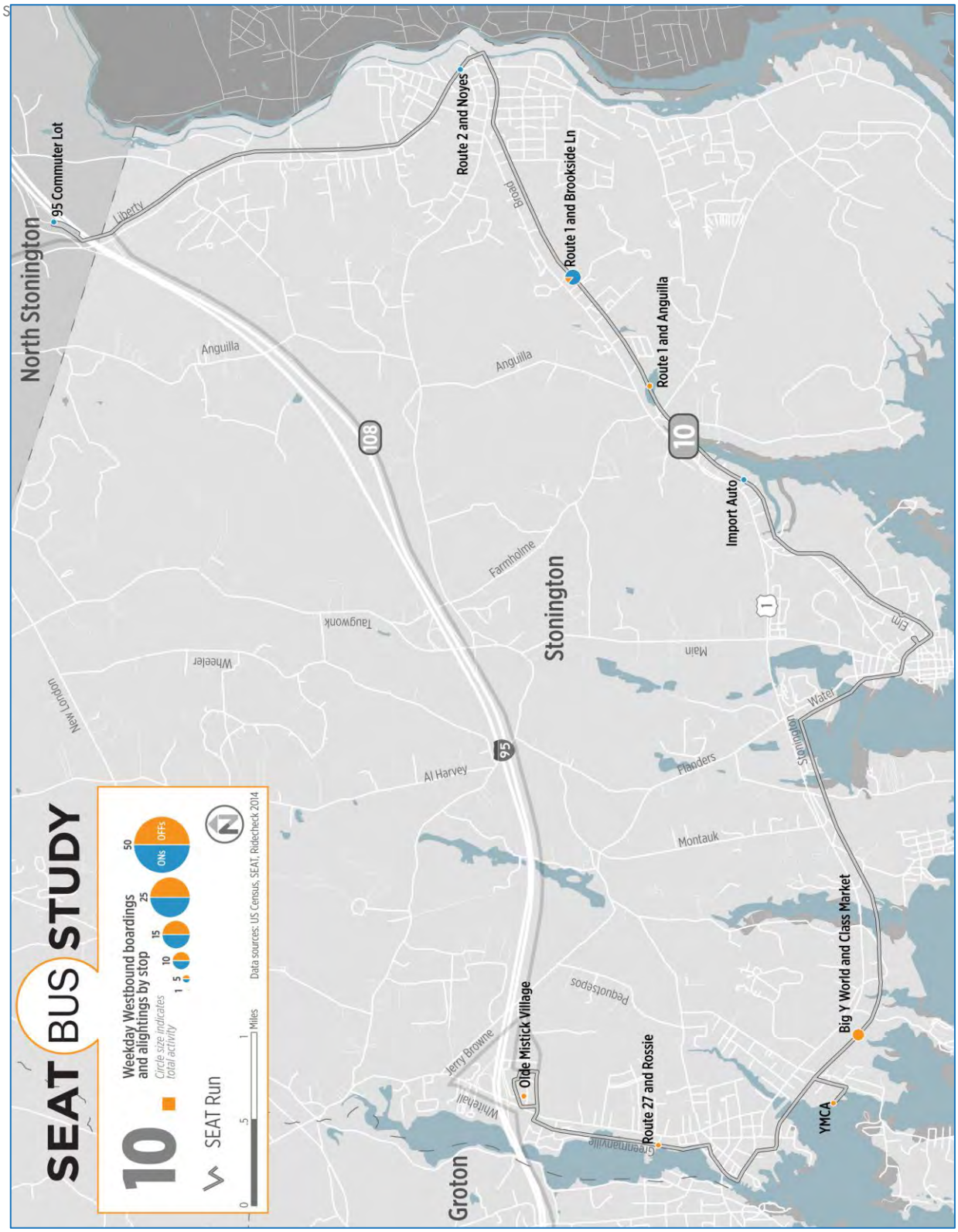
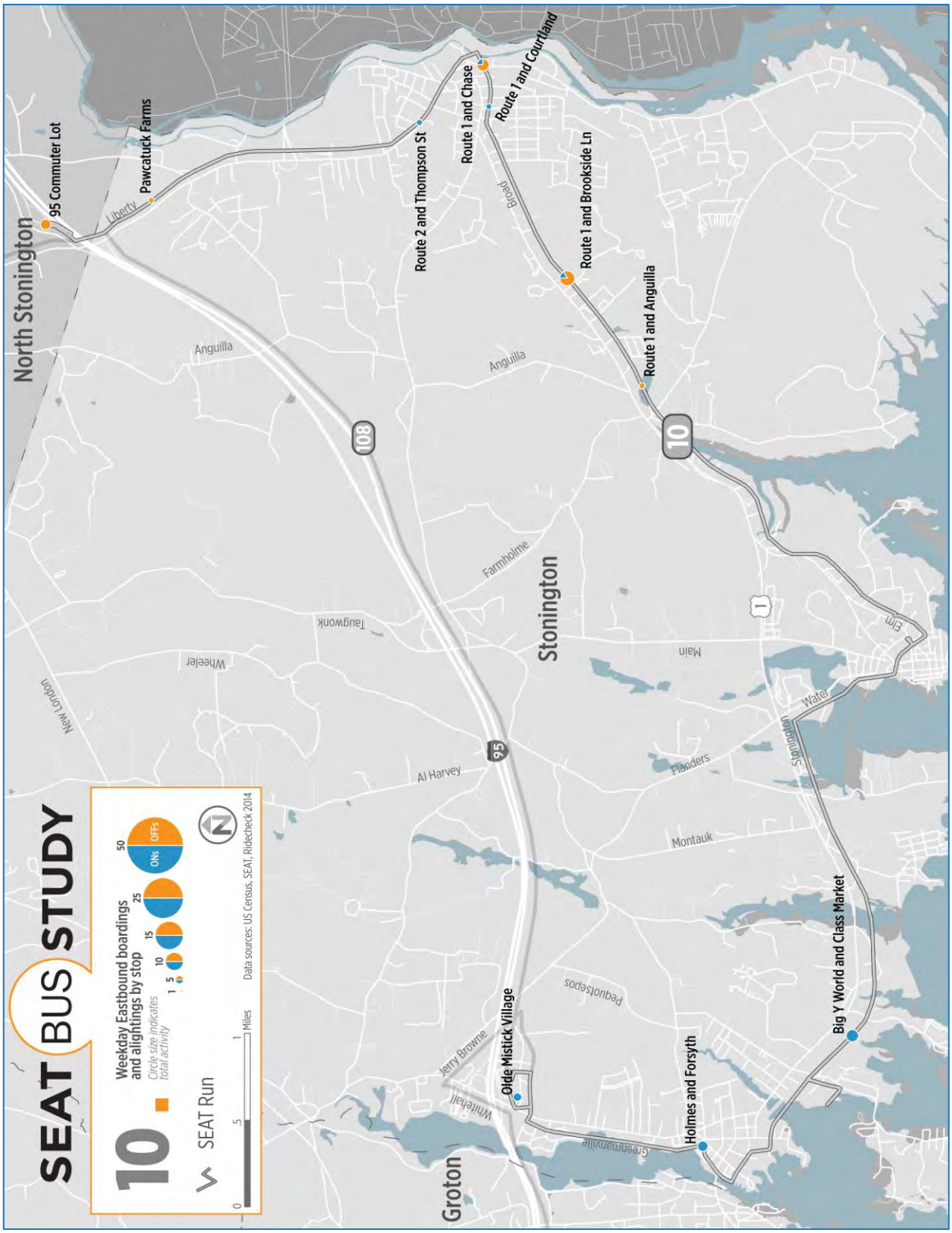


FIGURE 9 – EASTBOUND WEEKDAY RIDERSHIP BY STOP MAP



Ridership by Trip. While ridership on Run 10 is very low, activity is somewhat concentrated during the middle of the day. Most trips carry less than two passengers per day. The 11:15 AM trip and the 12:15 PM trips, however, carry 5 and 7 passengers respectively, which are the highest of any trip. The 7:15 AM westbound trip carries no passengers.

FIGURE 10 – WESTBOUND WEEKDAY RIDERS PER TRIP

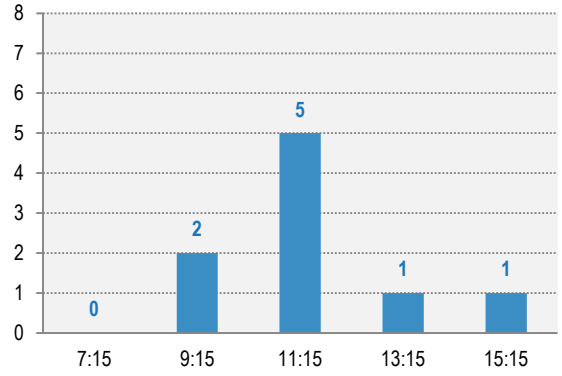
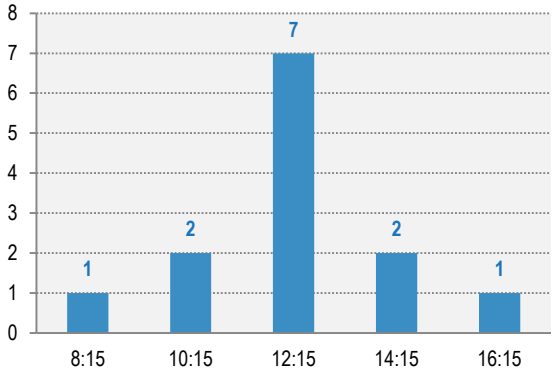


FIGURE 11 – EASTBOUND WEEKDAY RIDERS PER TRIP



Source: SEAT Ridecheck 2014

Performance. Although Run 10 outperforms other runs in terms of on-time performance, it performs poorly on all other measures. Run 10 serves just over two passengers on an average per trip, and serves fewer passengers per revenue hour than every other run (see Figure 13). Run 10 is an expensive service to provide for the very few people that use it.

Several reasons contribute to its unproductivity. The operating environment is very low in density, and thus transit demand by nature is lower than in more densely developed areas. The uncoordinated schedule also contributes to low demand, as the run is poorly coordinated with connecting services, forcing passengers to either wait for nearly two hours or use alternate modes of transportation. This limits the run to providing very localized service for only highly-transit dependent individuals.

FIGURE 12 – PERFORMANCE MEASURES

Performance Measure	Weekday		Saturday		Sunday	
	Run 10	System Avg	Run 10	System Avg	Run 10	System Avg
Passengers per Revenue Vehicle Hour	2.2	20.9	-	16.4	-	12.9
Passengers per Revenue Vehicle Mile	0.1	1.6	-	1.2	-	0.8
Average Speed (mph)	32.3	16.2		15.2		17.6
On-Time Performance Reliability*	82.0%	57.9%	-	52.8%	-	40.8%

*On-Time Performance is the percent of sampled observations where the bus arrived at timepoints within 5 minutes of the scheduled time.
Source: SEAT Analysis Factors 2014

FIGURE 13 – WEEKDAY RIDERS PER REVENUE HOUR

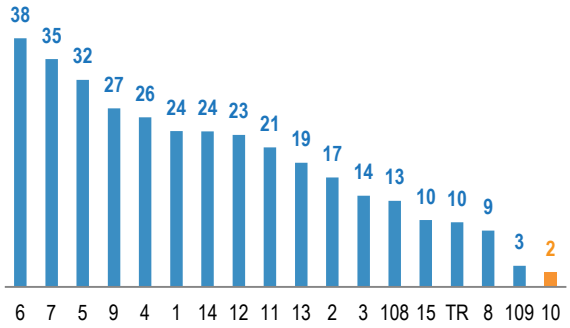
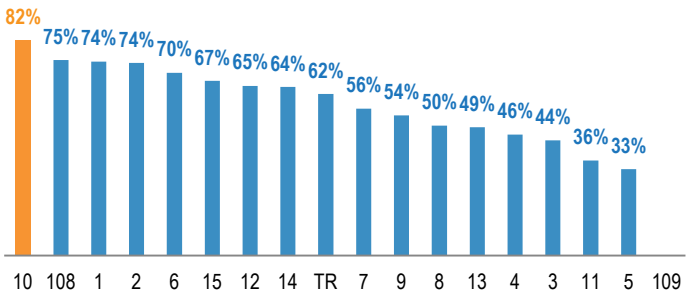


FIGURE 14 – WEEKDAY ON-TIME PERFORMANCE

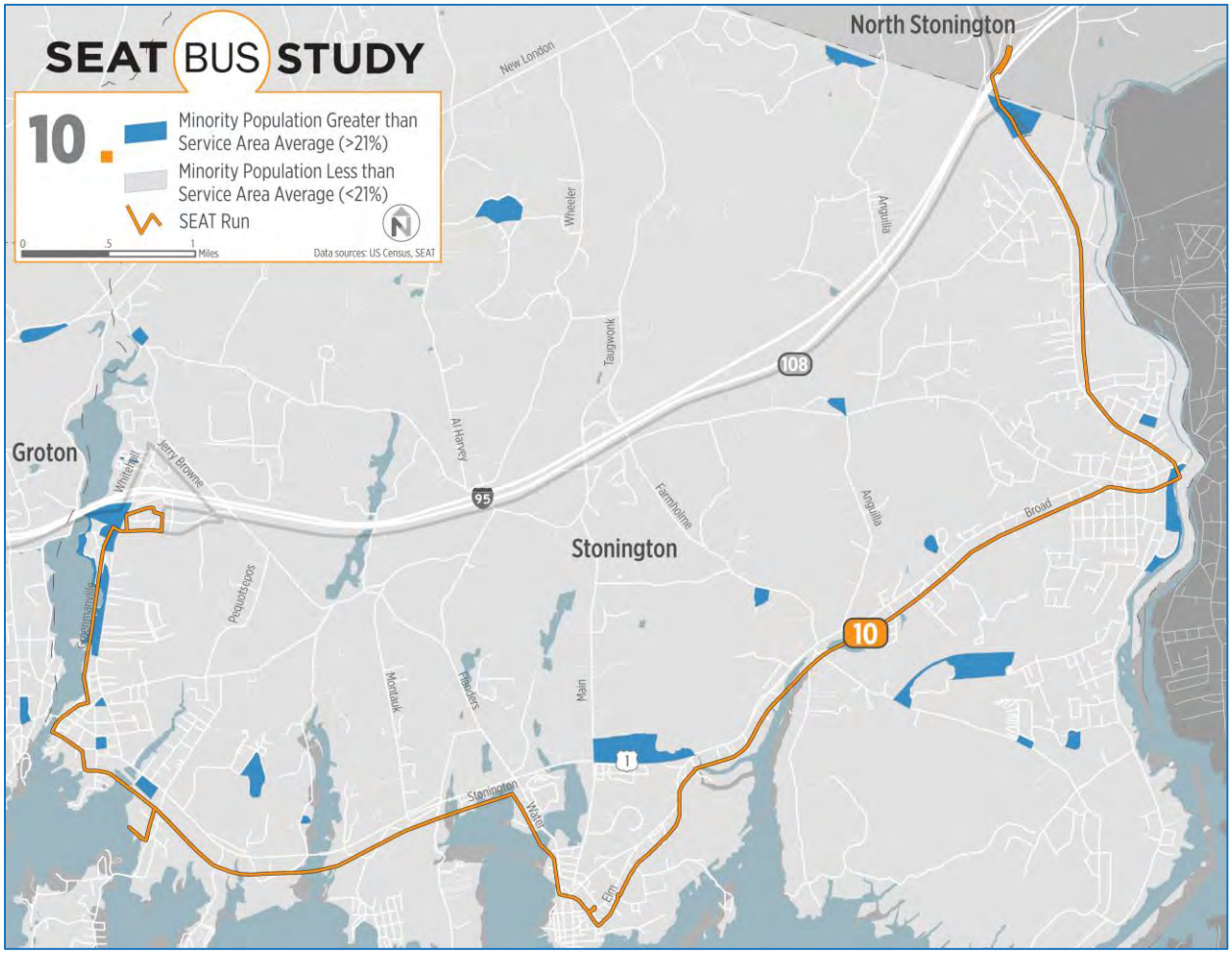


Source: SEAT Ridecheck 2014

Environmental Justice

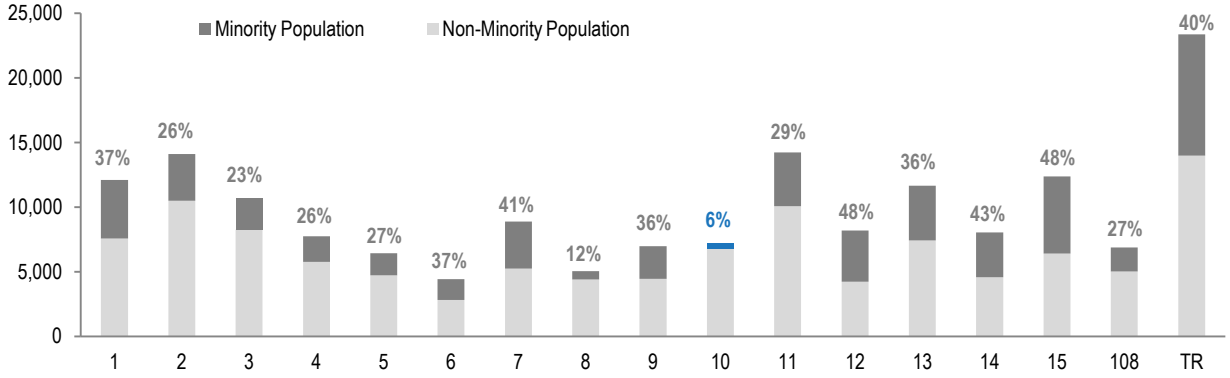
Run 10 predominately serves areas with a lower minority population than is found in the SEAT service area overall. Only 6% of the population served by Run 10 lives in census blocks that have a minority population greater than the overall service area average (21%), which is the lowest share of any run in the SEAT system.

FIGURE 15 – MAP OF BLOCKS WITH HIGH MINORITY POPULATIONS



Sources: US Census 2010, SEAT

FIGURE 16 – SERVICE TO BLOCKS WITH HIGH MINORITY POPULATIONS



Sources: US Census 2010, SEAT

SERVICE IMPROVEMENT OPTIONS

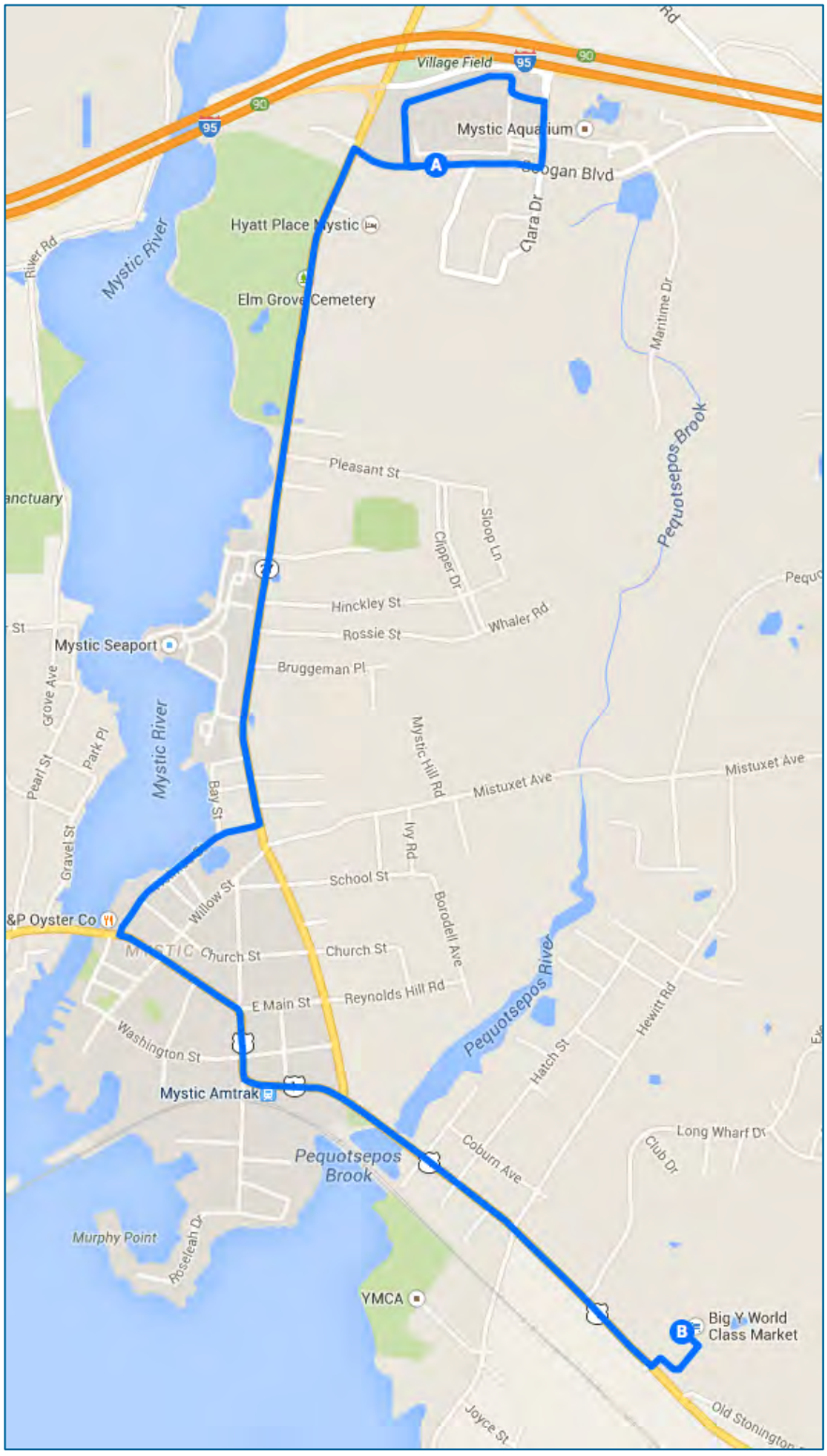
Run 10 is only one of two runs that serve the Mystic area, but as designed it is an unproductive run that ranks at or near the bottom of the system in most performance measures, principally due to very low ridership. Some contributing factors include the run's geographic isolation from the rest of the system, uncoordinated schedules for connections to the rest of the SEAT system, as well as the low-density environment and lack of significant activity centers in the service area. Opportunities to improve Run 10 include:

- **Discontinue Run 10.** Run 10 carries very few riders, ranking second lowest of all SEAT runs, and the run could be discontinued in order to reallocate resource for more productive use elsewhere.
- **Time transfers at Olde Mistick Village between Runs 10 and 108.** Currently, Run 10 arrivals at Olde Mistick Village are timed 15 minutes *after* the departure of Run 108, meaning that passengers would have to wait nearly two hours if they want to continue their journey to New London. This effectively limits the run to only local circulation, cutting off the rest of the SEAT service area as a travel option for local riders. Rescheduling the service to provide a more convenient connection with Run 108 would give riders more attractive access to a larger number of regional destinations throughout the SEAT system.
- **Advertise connection opportunities.** Run 10 serves an isolated area in the southeastern corner of the SEAT service area, with a poor connection to the rest of the SEAT system. This effectively limits the run's market to very basic local trips only. In conjunction with a more coordinated schedule for connecting with Run 108, the public schedules for Run 10 could advertise the ability to make this new and convenient connection, opening up the entire SEAT service area as new travel options.
- **Operate Run 10 as a Flex Service.** Run 10 has very low passengers per trip, and with its low density environment, could merit Flex service. Flex service would allow rider-requested deviations off of the fixed alignment to serve areas that do not have the density to support regular transit but still have transit need. Fixed timepoints along a run would allow for regularity of such services.
- **Explore partnership with RIPTA to provide service in Pawcatuck**. The Rhode Island Public Transit Authority (RIPTA) provides express service between Westerly and Providence

(Route 95X), which could be extended to serve the core of Pawcatuck relatively easily. RIPTA's Route 95X serves the Westerly Amtrak station and park-and-ride, which is just across the Rhode Island border from Pawcatuck, and RIPTA has considered crossing into Pawcatuck to use State Route 2 as a quicker way to I-95. SEAT could partner with RIPTA to provide such a service, which would benefit SEAT by serving the core of Pawcatuck and also benefit RIPTA by giving them a faster way to I-95 to/from Providence.

- **Provide service to Westerly Amtrak.** Run 10 could enhance connections to Amtrak and RIPTA by crossing into Rhode Island to serve the Amtrak station. Proper timing would be required in order to coordinate transfers between services, and adding such a stop could add additional run time due to the deviation.
- **Truncate the service at Pawcatuck/Westerly.** There is very little ridership activity at the I-95 Commuter Lot, and service could be shortened to save resources for more productive use. The run could turn back in Pawcatuck and serve the Westerly Amtrak, which would still allow for a park-n-ride connection at the same time as providing additional transfer opportunities to Providence via RIPTA Route 95X.
- **Provide a special "Grocery Bus" service.** Instead of operating all day, provide a single midday roundtrip specifically catering to transit-dependent individuals in Brookside Apartments and other transit dependent populations on the run. Eliminating the other trips, which serve two or less people per day would allow resources to be spent on more productive uses elsewhere.
- **Redesign run to create attractive and targeted service within Mystic.** Run 10 currently serves a very limited market in the southeastern area of the SEAT service area, effectively trying to serve too much geographic area; as a result, service frequency is very low, connections to the rest of the system are poor, and the run is not an attractive option for most potential riders. Run 10 could be redesigned to provide very attractive service to the tourism and Mystic rider markets by focusing on the most transit-supportive destinations in Mystic. The run could provide very frequent (30-minute) service by serving only the most important destinations in Mystic, such as the Mystic Aquarium, Olde Mistick Village (and associated hotels such as Hyatt Place, Holiday Inn, Howard Johnson, and the Hilton), Mystic Seaport, Central Mystic, and the Big Y World Class Market (see Figure 17). While this run would serve much more limited service area, it would provide much more attractive and frequent service than Run 10 does today. By providing service every 30 minutes, it would also offer a more attractive connection to Run 108 and the rest of the SEAT system.
- **Explore alternative funding strategies with Mystic partners.** In coordination with the previous service improvement option that would redesign Run 10 to a tourism-based Mystic circulator, SEAT could partner with local Mystic organizations to help fund the service. The concept of a tourist trolley or similar tourism-oriented service has been explored many times in the past, and many local institutions have expressed a willingness to partner in a funding plan.

FIGURE 17 – SAMPLE REDESIGN OF RUN 10

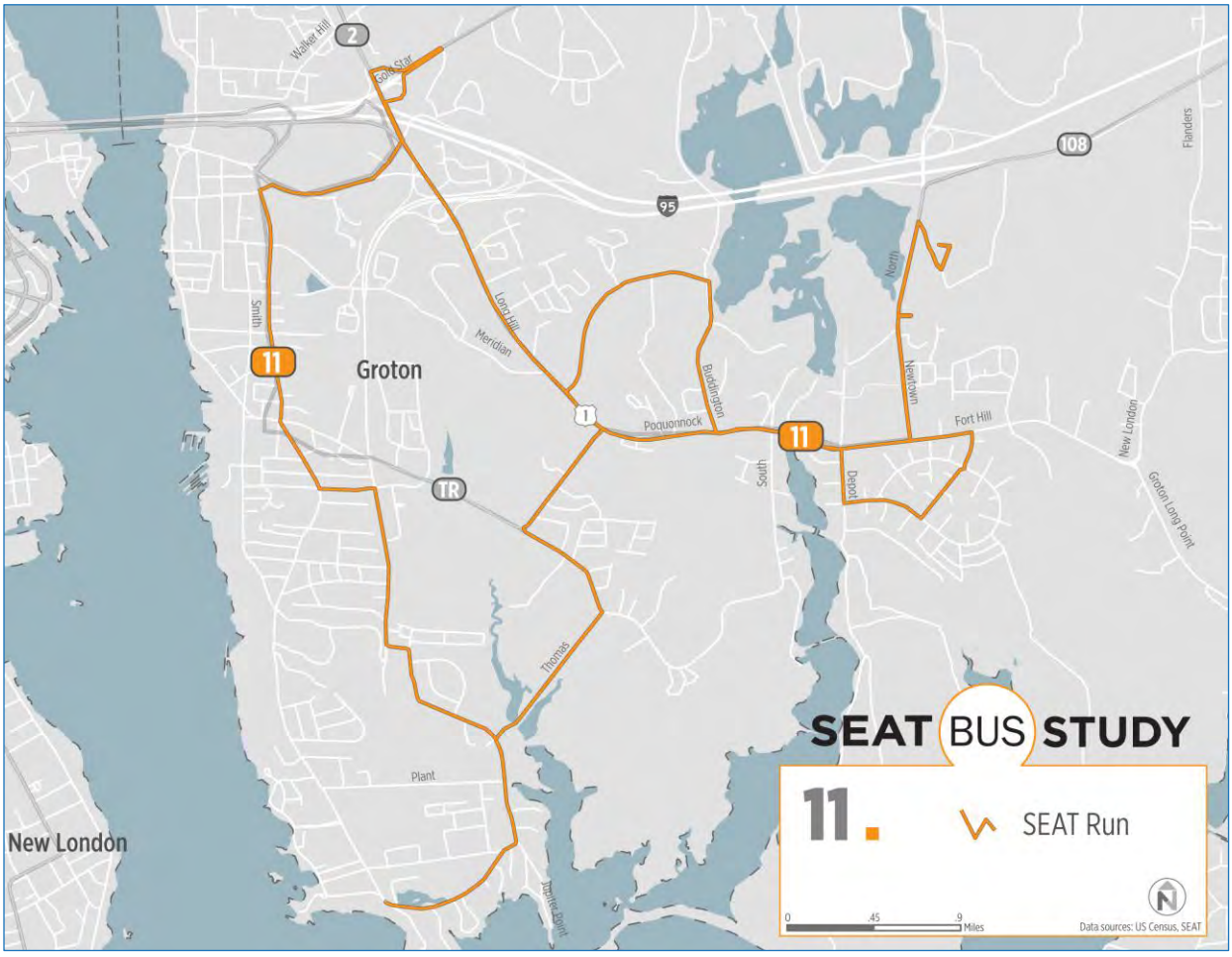


SERVICE EVALUATION

RUN 11 (GROTON LOCAL)

Service Design. Run 11 is a coverage-focused run that serves Groton essentially as a large one-way loop. The run begins at Plaza Court Shopping Center in Groton, operates south on Poquonock Road, High Rock Road, Thomas Road, and Shennecossett Road to the University of Connecticut, Avery Point. The run then turns around and travels north again on Shennecossett Road to Brandegee Road. The run proceeds west on Rainville Avenue and then north on Benham Road and Mitchell Street, and then east on Bridge Street crossing I-95 on Route 12 and Gold Star Highway (Route 184) to serve the Groton Stop & Shop and Wal-Mart. The run then returns south on Long Hill Road (Highway Route 1), and adds an additional loop in Poquonock Bridge area via Depot Road, Fitch Avenue, Midway Oval, and Fort Hill Road, and up on Highway Run 117 to serve Grasso Gardens, and then east on Hazelnut Hill Road to serve the Pequot Health Center. Run 11 finally backtracks on 117 to Fort Hill Road, does one last loop to AHEPA Housing via Buddington Road and Drozdyk Drive before returning to Plaza Court Shopping Center.

FIGURE 1 – RUN MAP



Service Schedule. Run 11's schedule is also very complex. Although service operates every hour, there are six unique stopping patterns that vary depending on the time of day. Several stops, including UConn Avery Point, Grasso Gardens, and AHEPA Housing are not served on every trip, adding complexity to the schedule and making it more difficult to understand and use.

Service generally operates hourly from 6:40 AM to 7:45 PM on weekdays; Saturday service is similar but ends an hour earlier. Sunday service starts an hour earlier, operating from 5:45 AM to 1:45 PM. Ridership activity on this first Sunday trip at 5:45 AM is relatively high for Sunday (just under 10 riders), but it is unclear where these riders are going due to data limitations of the flag system (the overwhelming majority of activity on these trips is occurring in between major intersections and therefore the automated passenger counter system does not record their location).

FIGURE 2 – SCHEDULE STATISTICS

Service Day	Span of Service	Frequency (min) Peak / Off-Peak	Daily Trips
Weekday	6:40 AM — 7:45 PM	60	27
Saturday	6:40 AM — 6:40 PM	60	25
Sunday	5:45 AM — 1:45 PM	60	17

Source: SEAT Run Schedules

Interaction with System. Run 11 offers limited connections with the rest of the system:

- At **Groton Square Shopping Center** (Wal-Mart), northbound Run 11 and Norwich-bound Run 2 are scheduled to arrive simultaneously every two hours. This allows for onward connections for Run 11 passengers to Norwich. This also allows passengers on Run 2 from New London to transfer for onward service to Groton. Run 3 also serves Groton Square and has a timed connection every other hour, for service between Groton and New London.
- At **Plaza Court**, New London-bound Run 108 and southbound Run 11 buses arrive simultaneously every two hours (on the :45 after) allowing for passengers from Norwich to connect onward to Groton, and passengers from Groton to connect onward to New London. Service is not timed in the opposite direction.
- Between Plaza Court and Pequot Health Center along Fort Hill Road and Newtown Road, Run 108 replaces every other trip for service to Pequot Health Center and Grasso Gardens.

Ridership by Service Day. Although Run 11's average weekday ridership is at the median among SEAT runs (see Figure 4), the run performs below the systemwide average in terms of ridership per trip (see Figure 5). The run's relatively high daily ridership but relatively low ridership per trip is an indication that productivity could improve with service design changes. On weekdays, an average of 10.5 riders use Run 11, compared to 13.0 for the SEAT average. On Saturdays, ridership per trip also performs below average with 6.8 riders per trip, while Sunday matches the average at 5.8 riders per trip.

FIGURE 3 – RIDERSHIP STATISTICS

Service Day	Daily Ridership	Ridership per Trip	
	Run 11	Run 11	System Avg
Weekday	283	10.5	13.0
Saturday	170	6.8	9.5
Sunday	98	5.8	5.8

Source: SEAT Ridecheck 2014

FIGURE 4 – AVERAGE WEEKDAY RIDERSHIP

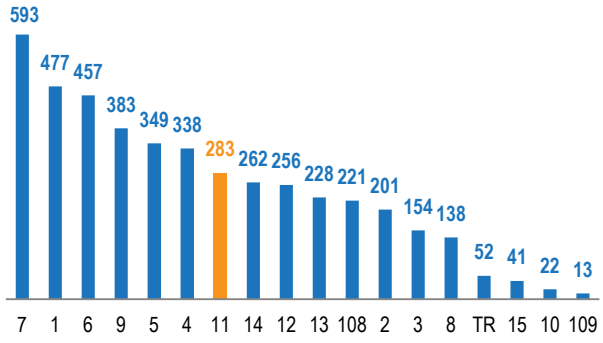
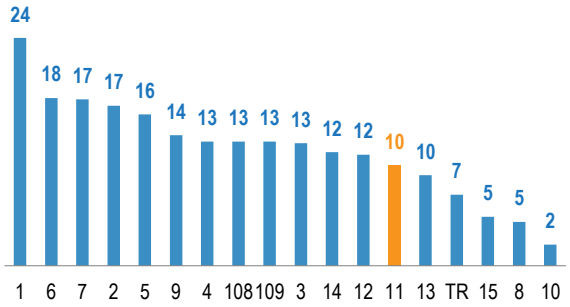


FIGURE 5 – AVERAGE WEEKDAY RIDERSHIP PER TRIP



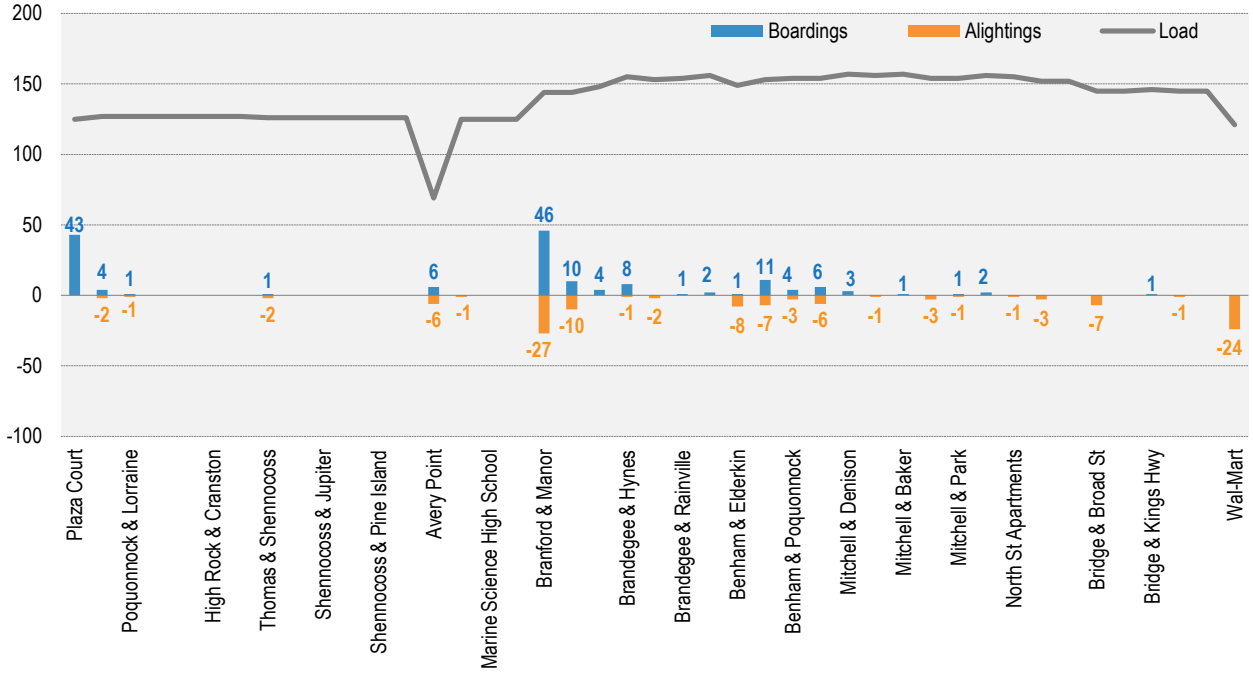
Source: SEAT Ridecheck 2014

Ridership by Stop. Ridership is relatively dispersed throughout Run 11, with higher activity levels at Plaza Court, Groton Square Shopping Center, and Wal-Mart. Due to the looping nature of the run, many riders stay onboard when the run switches directions at Wal-Mart, evidenced by the relatively consistent load onboard the vehicle throughout the run. Although ridership is dispersed along the run, there are some locations that have more significant boardings and alightings:

- **Plaza Court.** Plaza Court has 43 boardings and 17 alightings per day. Plaza Court not only serves a large cluster of retail establishments, but is also a transfer point for service to Norwich, Foxwoods Casino, and New London.
- **Branford Manor Apartments (Shennecosett Road)**. At Shennecosett Road and Branford Avenue, 48 passengers board and 27 disembark daily for Branford Manor Apartments.
- **Wal-Mart** has 20 daily boardings and 24 daily alightings.
- **Groton Square Shopping Center** has the most ridership on the line with 71 daily boardings and 73 daily alightings. Groton Square Shopping Center is also a transfer point for services to Norwich and New London via Run 3.
- **Benham Avenue and George Street** (serving a residential neighborhood) has 11 boardings and 7 alightings per day.

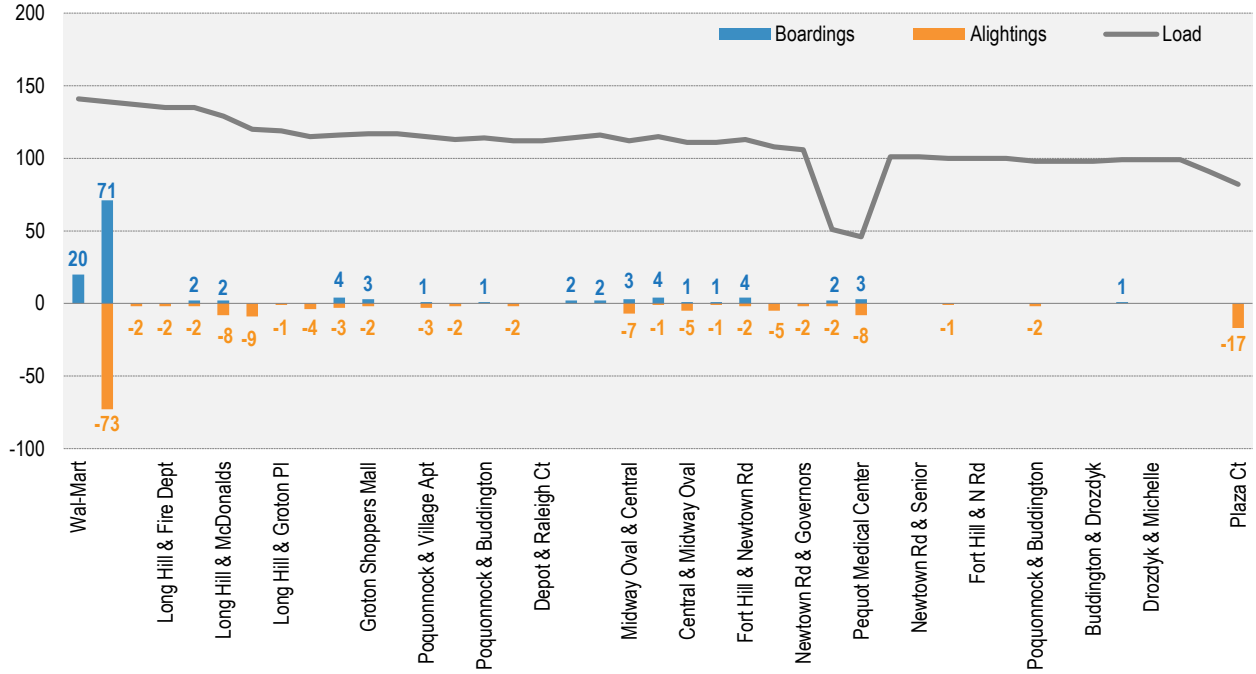
- **UConn Avery Point** is only served on select trips (about every other trip). On average, 6 boardings and alightings occur on these trips per day.
- **Pequot Medical Center on Hazelnut Hill Road** is only served on select trips. It averages 3 boardings and 8 alightings per day.

FIGURE 6 – AVERY POINT (SOUTH LOOP) WEEKDAY RIDERSHIP BY STOP CHART



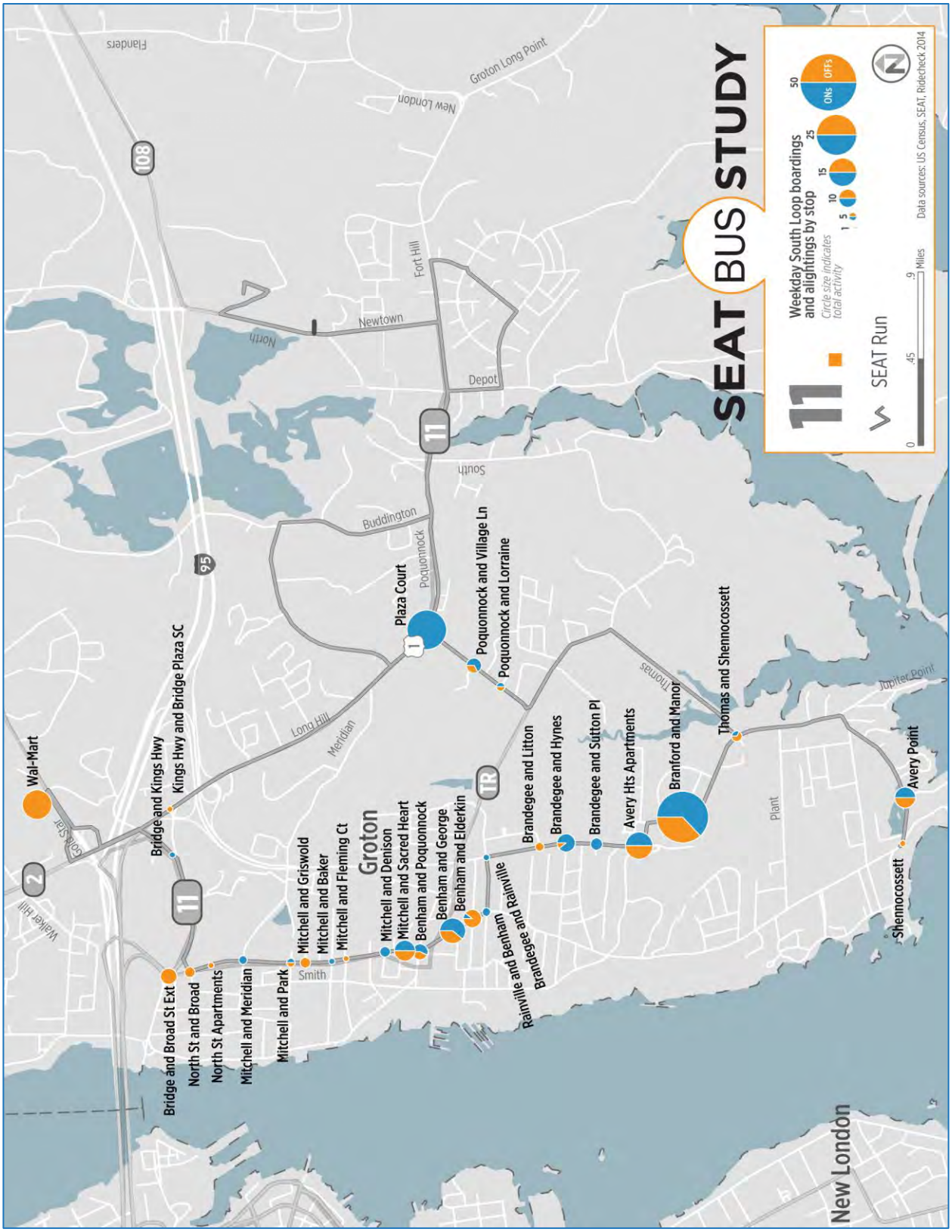
Source: SEAT Ridecheck 2014

FIGURE 7 – PEQUOT MEDICAL AND MIDWAY OVAL (NORTH LOOP) WEEKDAY RIDERSHIP BY STOP CHART



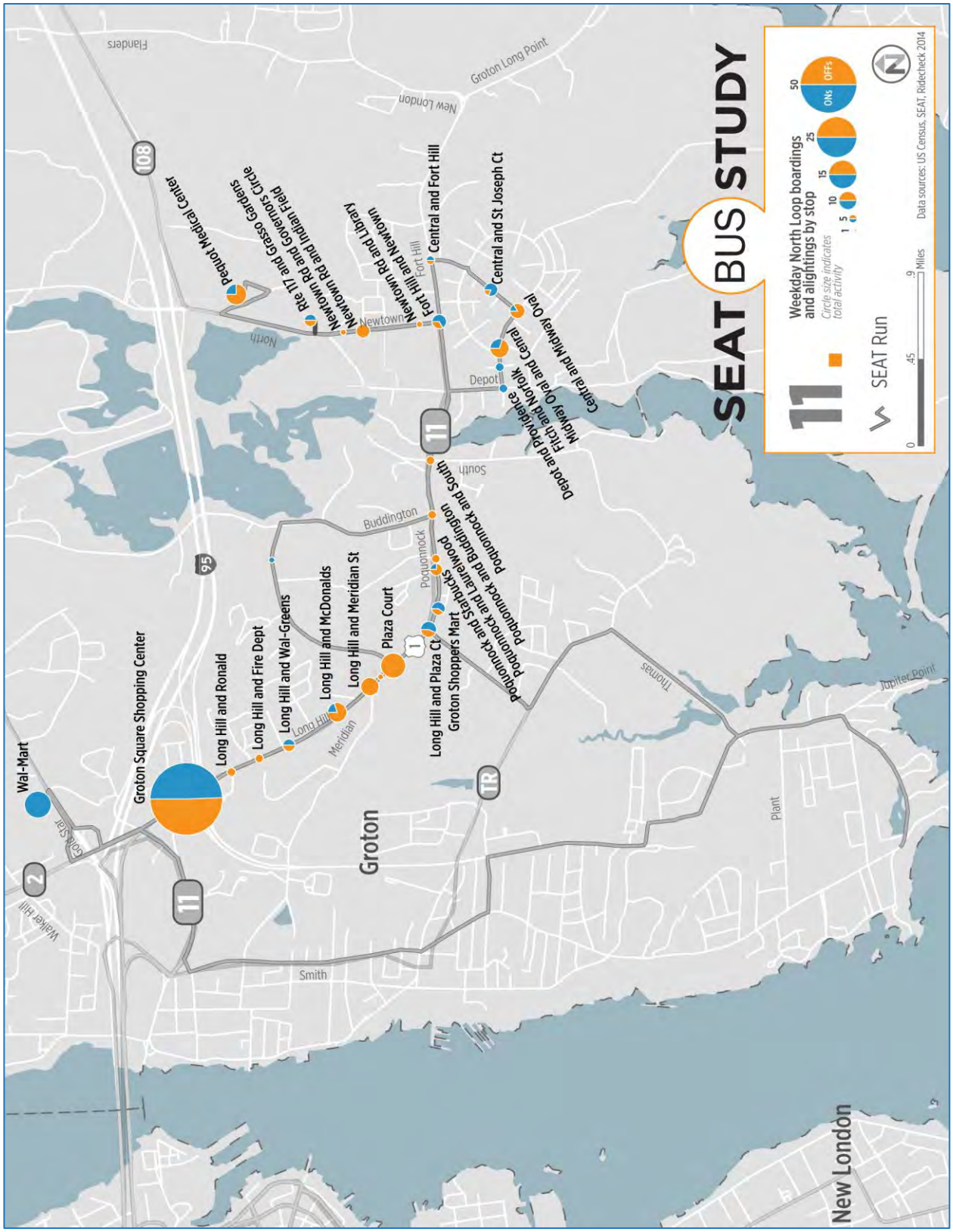
Source: SEAT Ridecheck 2014

FIGURE 8 – SOUTH LOOP WEEKDAY RIDERSHIP BY STOP MAP



Source: SEAT Ridecheck 2014

FIGURE 9 – NORTH LOOP WEEKDAY RIDERSHIP BY STOP MAP



Source: SEAT Ridecheck 2014

Ridership by Trip. Ridership on Run 11 does not have the traditional peaks in ridership during the peak periods, which indicates that the run primarily serves non-work trips. Run 11 has its highest ridership during the midday. Specifically, the 10:40 AM trip for the loop via Avery Point has 23 boardings, and the 1:05 PM trip on the northern loop (Midway Oval) also has 24 boardings. Generally, the southern portion has ridership that increases until 10:40 AM, while all subsequent trips have decreasing ridership. The last two trips have no boardings. On the northern portion of the run, the first trip has higher ridership than subsequent morning trips, followed by a surge of riders on one afternoon trip, followed by less ridership on all subsequent trips. The 7:05 PM trip has no ridership.

FIGURE 10 – SOUTH LOOP WEEKDAY RIDERS PER TRIP

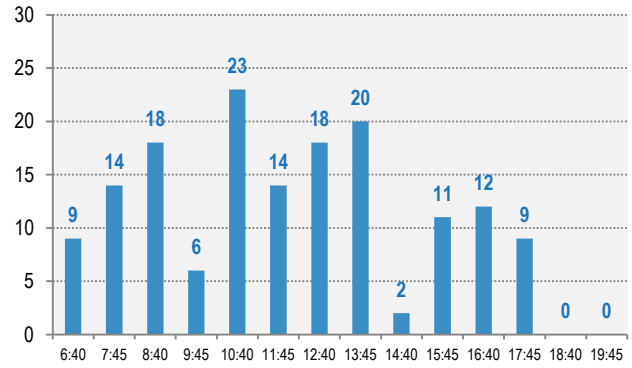
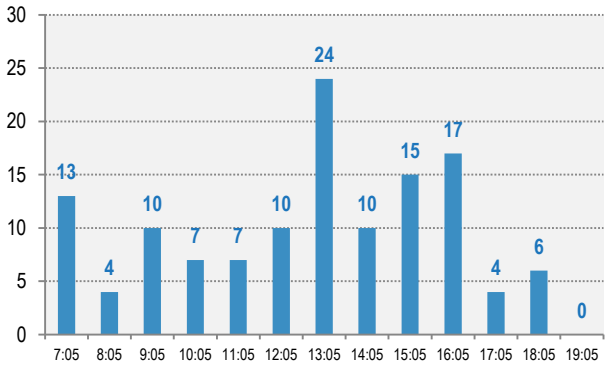


FIGURE 11 – NORTH LOOP WEEKDAY RIDERS PER TRIP



Source: SEAT Ridecheck 2014

Performance. Overall, Run 11 is fairly average in terms of run productivity (see Figure 12). On weekdays, there are 21.4 riders per revenue vehicle hour, which is slightly above the systemwide average of 20.9 (see Figure 13). In contrast, Saturday and Sunday service is below the systemwide average with 13.9 and 12.3 riders per hour respectively compared to 16.4 and 12.9 across the network.

Run 11 suffers from poor on-time performance, with only 36.3% of the weekday trips arriving on time, and even less on Sundays. Run 11 has the second lowest schedule adherence of all SEAT runs (see Figure 14). The run's alignment could be a reason for the number of delays; Run 11 has a very circuitous alignment that contains many turning movements, which introduces the potential for accumulating delays. Simplifying and straightening the alignment could potentially improve the run's on-time performance. Average speed is essentially at the SEAT system average.

FIGURE 12 – PERFORMANCE MEASURES

Performance Measure	Weekday		Saturday		Sunday	
	Run 11	System Avg	Run 11	System Avg	Run 11	System Avg
Passengers per Revenue Vehicle Hour	21.4	20.9	13.9	16.4	12.3	12.9
Passengers per Revenue Vehicle Mile	1.4	1.6	0.9	1.2	0.8	0.8
Average Speed (mph)	15.7	16.2	15.7	15.2	15.7	17.6
On-Time Performance Reliability*	36.3%	57.9%	69.8%	52.8%	25.9%	40.8%

*On-Time Performance is the percent of sampled observations where the bus arrived at timepoints within 5 minutes of the scheduled time.
Source: SEAT Analysis Factors 2014

FIGURE 13 – WEEKDAY RIDERS PER REVENUE HOUR

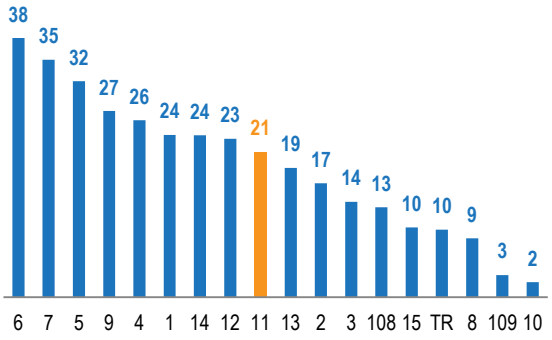
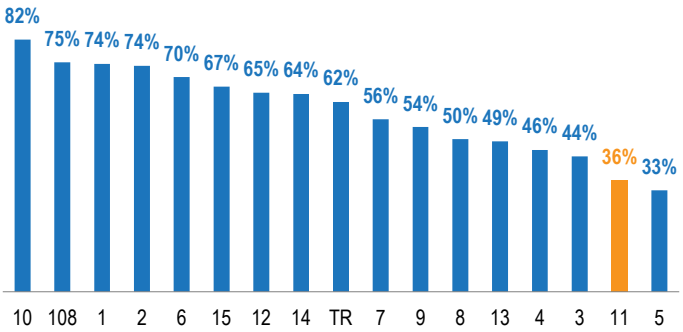


FIGURE 14 – WEEKDAY ON-TIME PERFORMANCE

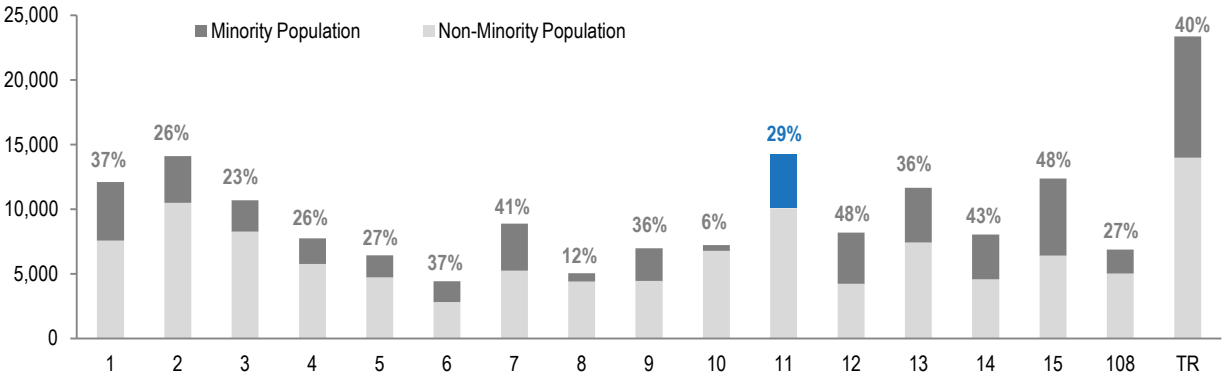


Source: SEAT Ridecheck 2014

Environmental Justice

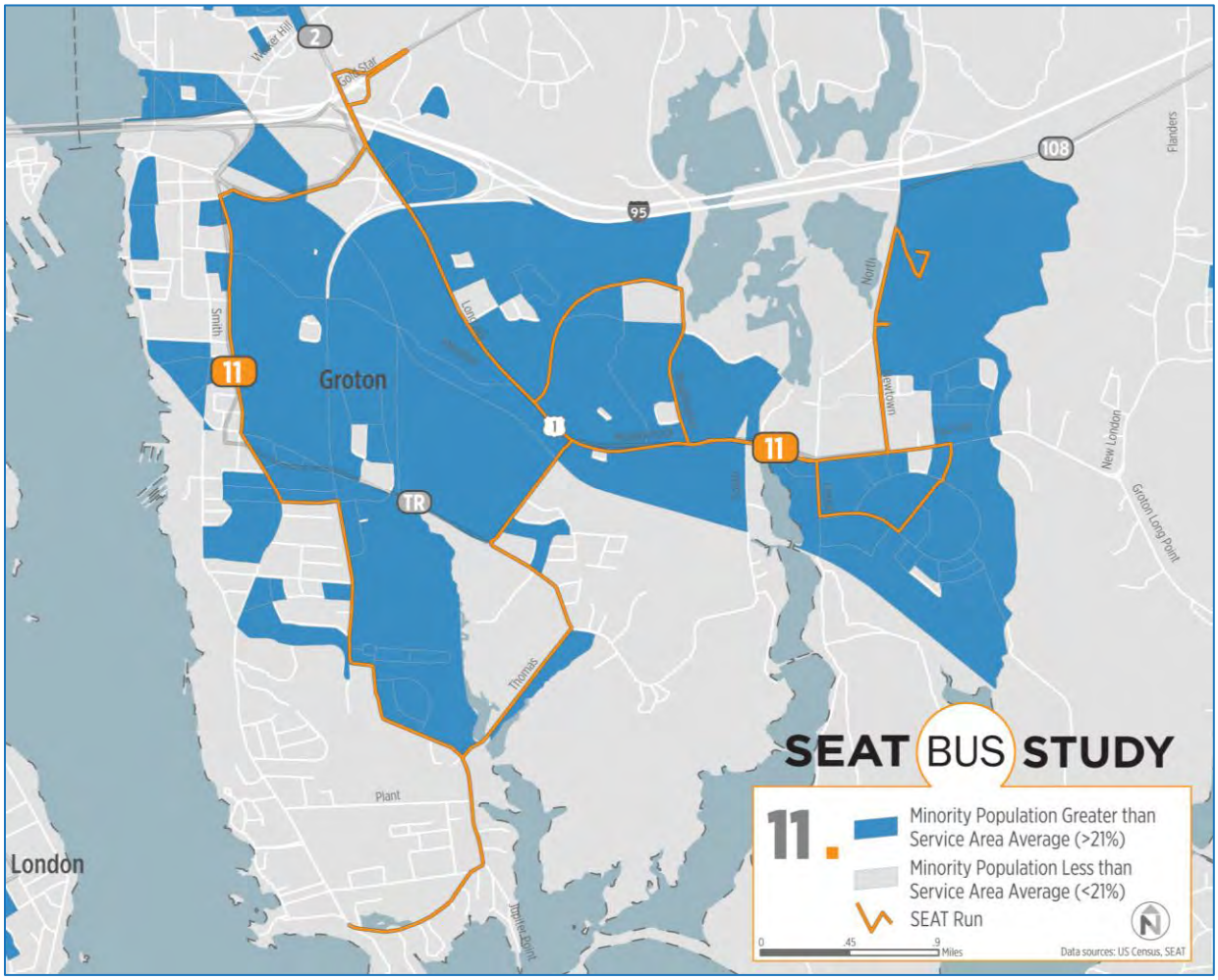
Run 11 predominately serves areas with a slightly higher minority population than is found in the SEAT service area overall. Just under one-third (29%) of the population served by Run 11 lives in census blocks that have a minority population greater than the overall service area average (21%). As shown in Figure 16, these minority populations are distributed through much of Groton, especially south of I-95.

FIGURE 15 – SERVICE TO BLOCKS WITH HIGH MINORITY POPULATIONS



Sources: US Census 2010, SEAT

FIGURE 15 – MAP OF BLOCKS WITH HIGH MINORITY POPULATIONS



Sources: US Census 2010, SEAT

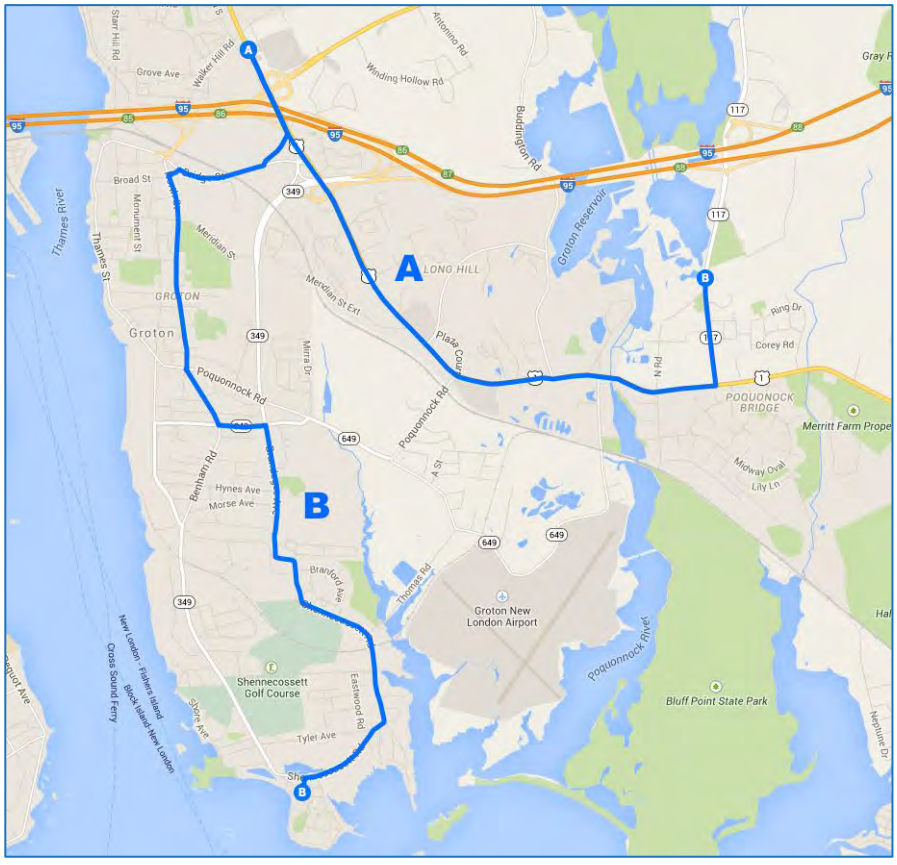
SERVICE IMPROVEMENT OPTIONS

Although Run 11 performs at the system average in terms of ridership productivity, there are many opportunities to improve the attractiveness of the run. The run alignment is very complex and circuitous, and the run schedule is similarly complex. This is confusing for new riders trying to understand both the alignment and schedule. Also, because of the one-way nature of the loop pattern, passengers would have to complete the entire loop in some part of their round trip. This adds unnecessary travel time for short local trips, reducing the attractiveness of the service.

There are some key demographics along the run that benefit from service. Specifically, UConn Avery Point could be a major ridership generator due to the number of students, a demographic group more likely to use public transit than the typical resident. However, because of the confusing and circuitous alignment and inconsistency of service, Run 11 serves few passengers at the campus. Opportunities to improve Run 11 include:

- **Operate two separate runs instead of one large loop.** The current loop structure particularly with the various stopping patterns (service variants) is confusing and makes the run difficult to understand and use. The run could be simplified by truncating at the Groton Shopping Center (Wal-Mart) and providing bidirectional service on two runs. This design would simplify the service alignments, provide higher quality and more attractive coverage to productive areas, limit the amount of backtracking, and improve schedule simplicity. Figure 17 shows the potential for such service, though some interlining or schedule adjustments may be necessary. Interlining between the two runs may not be accommodated in a 60 minute cycle time and would require more vehicles, reductions in frequency, or interlining with another run.

FIGURE 16 – CONCEPTUAL DESIGN OF TWO SEPARATE GROTON RUNS



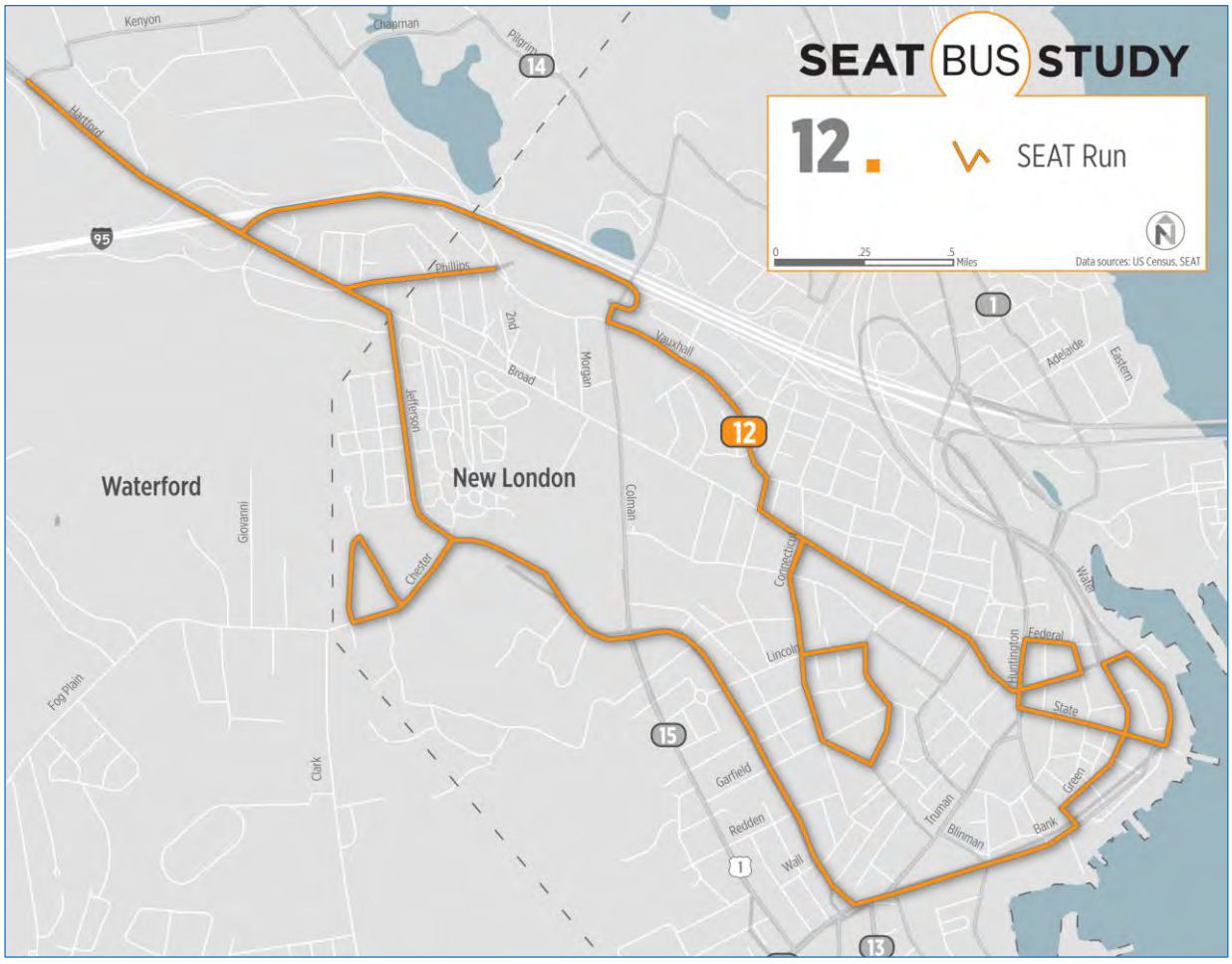
- **Replace service on Midway Oval/Pequot Medical loop with Run 108.** In order to provide bidirectional service on a single run as shown in Figure 17, it may require shortening the red run and not serving Pequot Medical in order to maintain an even cycle time. Currently Run 108 provides service to Pequot Medical via Fort Hill Road, but only every two hours and the center would see a reduction in service under this scenario unless Run 108 was modified to serve the medical center every trip.
- **End Service at 6:40 PM.** Trips after 6:40 PM have no recorded ridership, and therefore service could end one hour earlier to better match service to demand.
- **Discontinue Sunday service.** Sunday service on Run 11 is very unproductive, carrying an average of just six daily riders. The low demand on Sundays may not justify providing service, and it could be discontinued in order to focus resources on productive service.
- **Adjust Sunday service span to start and end later.** Sunday service on Run 11 starts and ends unusually early (5:45AM – 1:45PM). Ridership during the first few hours of Sunday service is very low (not shown in this evaluation but evidenced by automated passenger counter data) and unproductive. Service could start and end an hour or two later in order to better match demand.
- **Update schedules and run maps on SEAT website.** In August 2014, Run 11's alignment was adjusted in order to improve run times; it no longer operates via Plant Street and Eastern Point Road. The schedule and the map on the webpage should be updated to reflect these changes.

SERVICE EVALUATION

RUN 12 (JEFFERSON AVE / CRYSTAL MALL / NEW LONDON SHOPPING CENTER / SENIOR CENTER)

Service Design. Run 12 is a coverage-focused run that forms a large clockwise loop, serving downtown New London, several apartment complexes, and various shopping centers. The run begins at New London Union Station and heads south on Eugene O'Neill Drive, then southwest on Green Street and State Route 641/Bank Street, then north on Jefferson Avenue. The run makes a deviation to serve Eagle Pointe Apartments at Chester Street and then continues on Jefferson Avenue and State Route 85/Hartford Turnpike to the Crystal Mall. The run then returns south on the Hartford Turnpike, then Phillips Street to access the New London Shopping Center. From this shopping center, the run loops back via Phillips Street, then around the back of the shopping center on South Frontage Road to Vauxhall Street and Broad Street. A second deviation loop occurs at Connecticut Avenue to serve a neighborhood and middle school. Proceeding south again on Broad Street, the run makes another loop at the Holiday Inn on Governor

FIGURE 1 – RUN MAP



Winthrop Boulevard, Union Street, Federal Street, and then on Huntington Street, followed by a southeast turn onto State Street to the New London Union Station.

Service Schedule. Run 12 has a simple schedule considering the complexity of its run alignment. Service operates every hour from 8:00 AM to 6:25 PM on Mondays through Saturday. There is no Sunday service.

FIGURE 2 – SCHEDULE STATISTICS

Service Day	Span of Service	Frequency (min) Peak / Off-Peak	Daily Trips
Weekday	8:00 AM — 6:25 PM	60	22
Saturday	8:00 AM — 6:25 PM	60	22
Sunday	-	-	-

Source: SEAT Run Schedules

Interaction with System. Run 12 offers connections to other SEAT runs at the New London Union Station. Outside of this major transfer point, Run 12 offers transfers and interacts with other lines at the following locations:

- On Green Street and Bank Street, there is overlap with Runs 3 and 14.
- Run 15 provides evening service on several segments where Run 12 operates during the day. Specifically, Run 15 provides evening service on Jefferson Avenue and the Hartford Turnpike between Bank Street and Crystal Mall. Run 15 also serves the deviation to Eagle Pointe Apartments via Chester Street.
- Run 14 operates in the opposite (counter-clockwise) direction, and operates within close proximity to Run 12's Jefferson Avenue alignment. Connections can also be made between Run 12 and 14 at the Crystal Mall and the New London Shopping Center.
- The deviation to serve Williams Street near C.B. Jennings Elementary School is also served by Run 13.
- Montauk Avenue at Bank Street can be used as a transfer point between Run 12 and Run 13, although due to scheduling, it would provide little or no time benefit compared to transferring at the main New London Union Station hub.

Ridership by Service Day. Run 12 carries 256 passengers per day on weekdays and 260 on Saturday. This indicates that ridership is fairly consistent between service days. Despite total daily ridership being ranked in the middle systemwide, its ridership per trip is below the systemwide weekday average (11.6 riders per trip versus 13.0 systemwide). On Saturday, Run 12 actually carries slightly more riders than it does on weekdays, probably due to the number of shopping centers along the run. Consequently, the average ridership per trip is higher than the systemwide average.

FIGURE 3 – RIDERSHIP STATISTICS

Service Day	Daily Ridership	Ridership per Trip	
	Run 12	Run 12	System Avg
Weekday	256	11.6	13.0
Saturday	260	11.8	9.5
Sunday	-	-	5.8

Source: SEAT Ridecheck 2014

FIGURE 4 – AVERAGE WEEKDAY RIDERSHIP

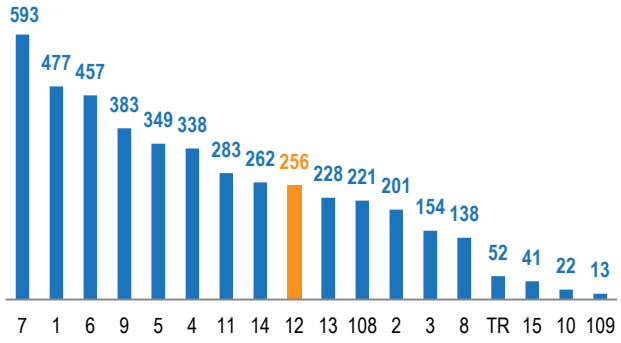
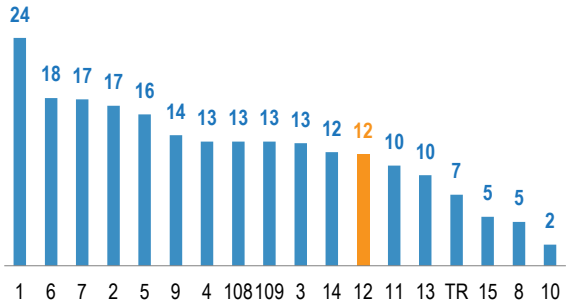


FIGURE 5 – AVERAGE WEEKDAY RIDERSHIP PER TRIP

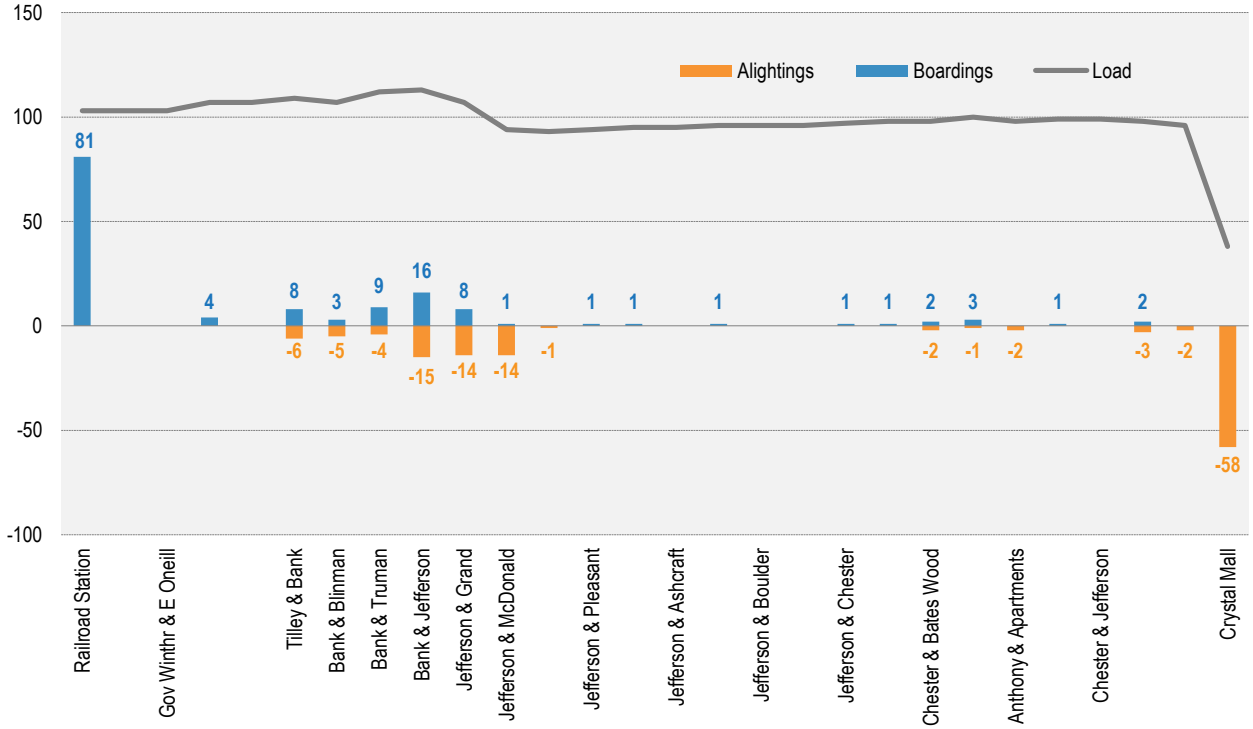


Source: SEAT Ridecheck 2014

Ridership by Stop. Ridership patterns on Run 12 suggest the primary function of serving the various shopping centers on the run. Particular areas of high ridership activity are as follows:

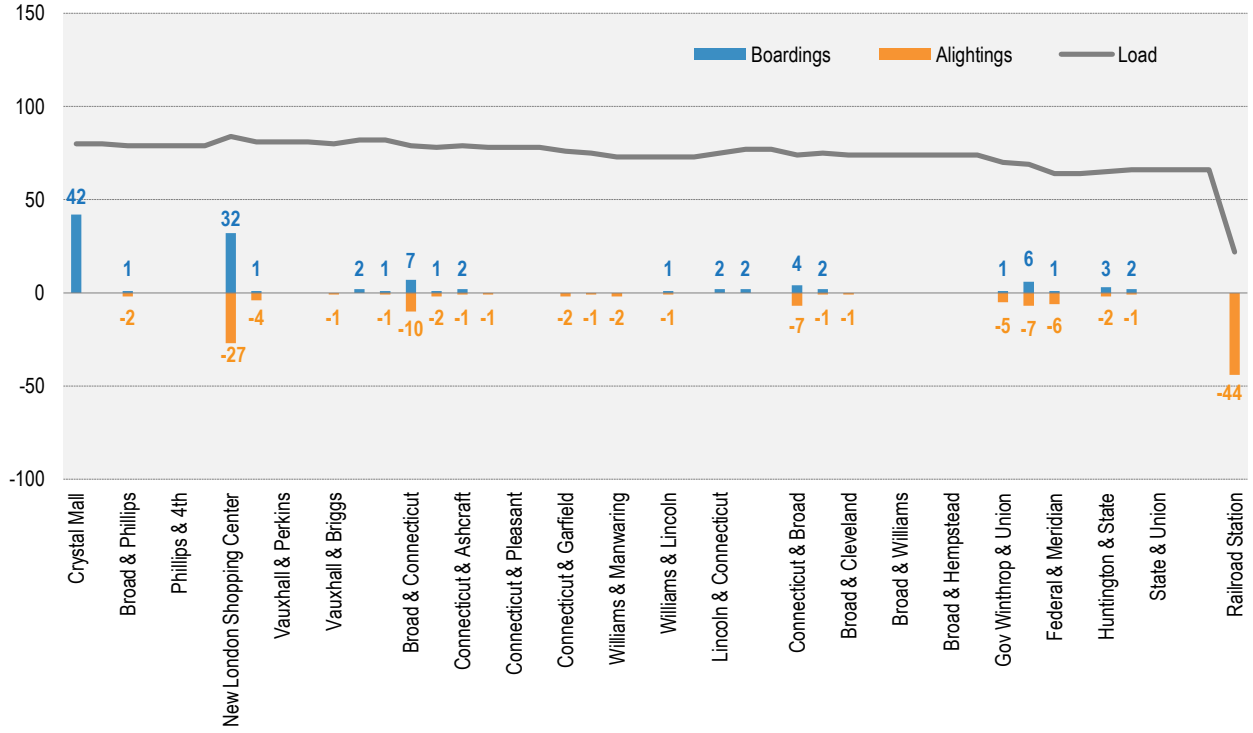
- **New London Union Station** is the highest ridership stop on the line with 81 boardings and 44 alightings. In addition to offering service to New London due to its central location, the stop also is a major transfer point to other local and regional services.
- **Crystal Mall** is a regionally important shopping center and the second highest ridership stop with 42 boardings and 58 alightings.
- **New London Shopping Center** has 32 boardings and 27 alightings.
- **Jefferson Avenue** has a fair amount of ridership activity along the corridor. Bank Street has 16 boardings and 15 alightings. There is a small cluster of shops in this area bordering a primarily residential neighborhood. Grand Street has 8 boardings and 14 alightings, and McDonald Street has 2 boardings and 14 alightings.
- **Broad Street at Connecticut Avenue** is served twice due to the looping of the alignment, and has a total of 11 boardings and 17 alightings.

FIGURE 6 – WESTBOUND WEEKDAY RIDERSHIP BY STOP CHART



Source: SEAT Ridecheck 2014

FIGURE 7 – EASTBOUND WEEKDAY RIDERSHIP BY STOP CHART



Source: SEAT Ridecheck 2014

FIGURE 8 – WESTBOUND WEEKDAY RIDERSHIP BY STOP MAP

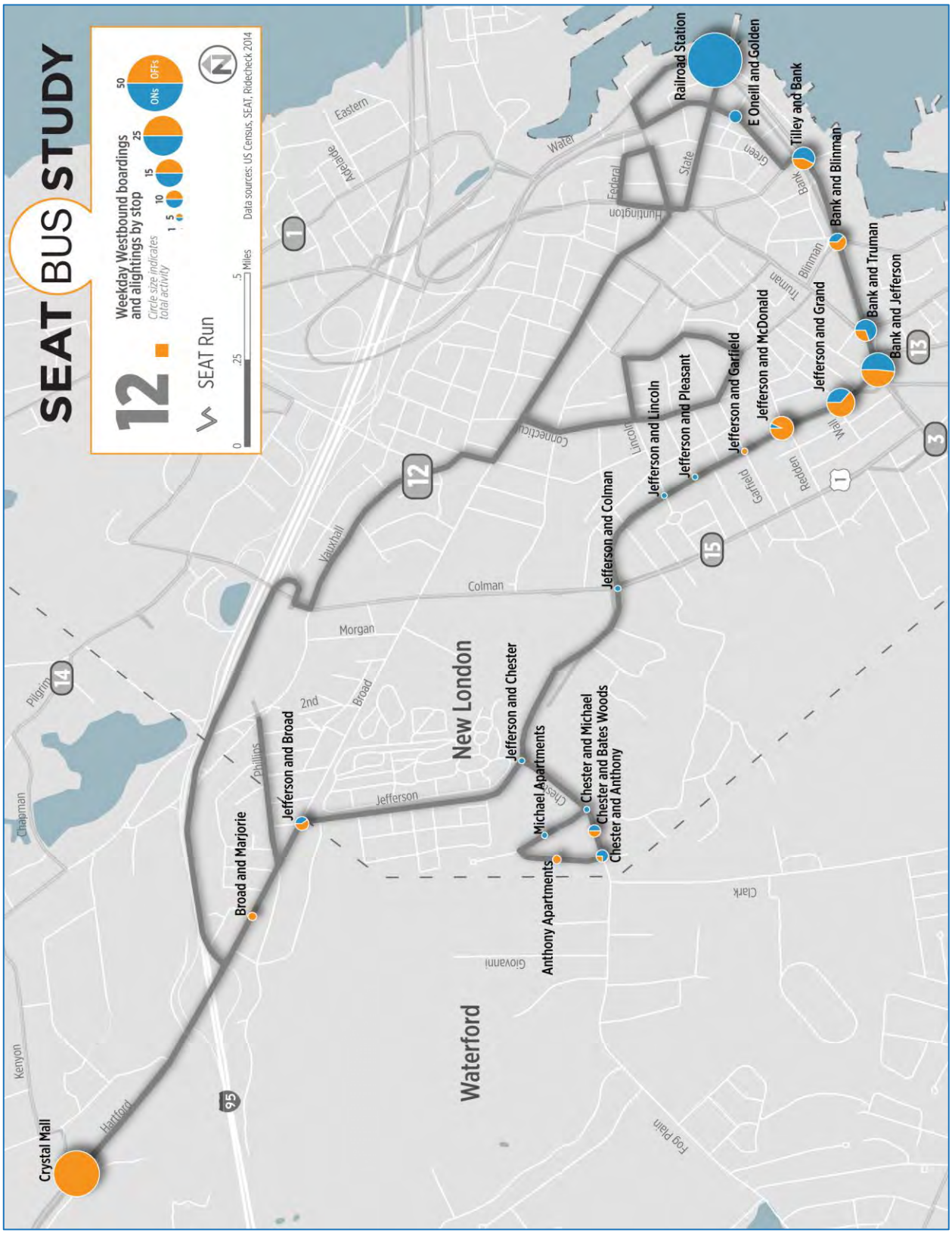
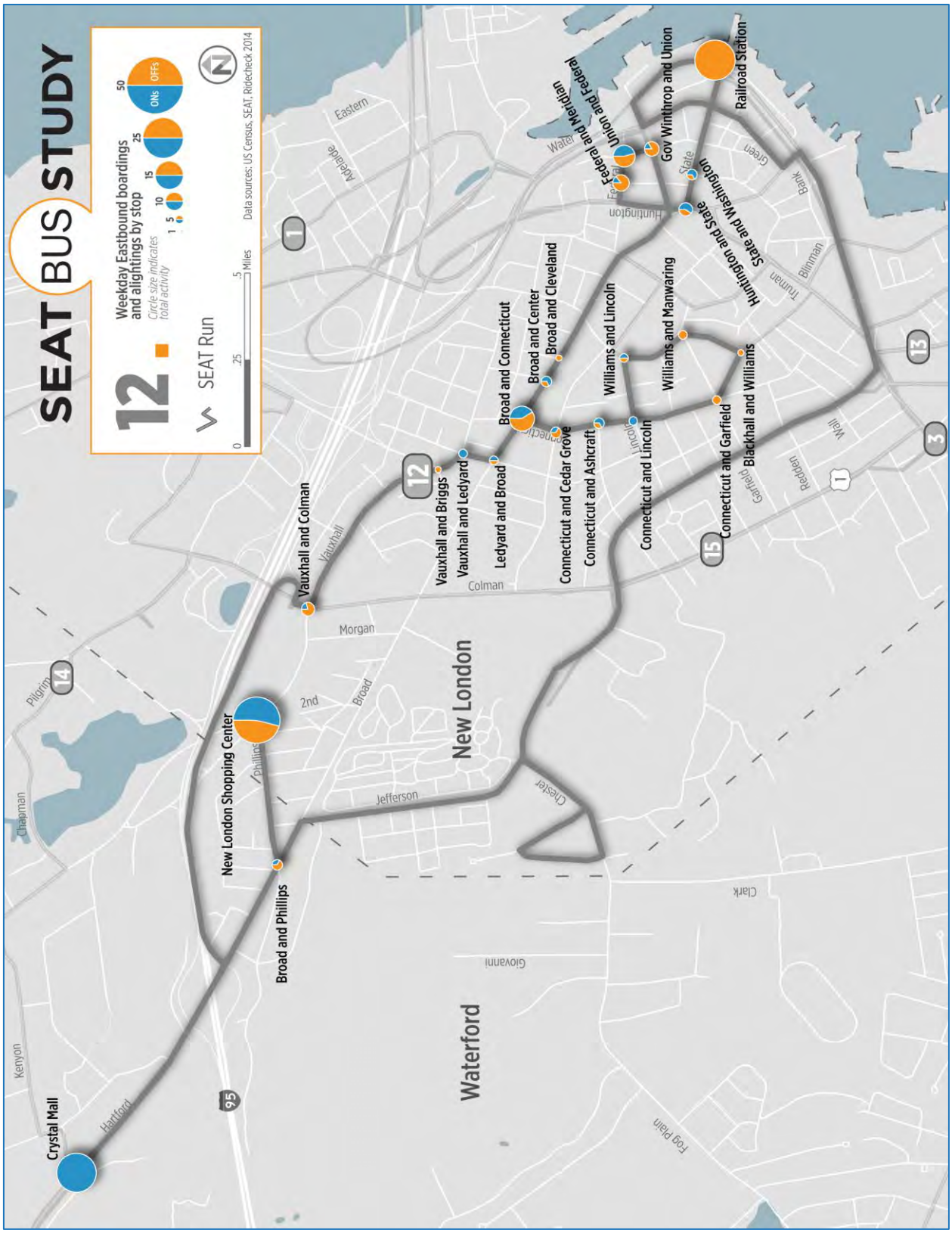


FIGURE 9 – EASTBOUND WEEKDAY RIDERSHIP BY STOP MAP



Ridership by Trip. Ridership on Run 12 is slightly directional by time of day, with higher ridership during the mid and late morning heading westbound, and in the afternoon heading eastbound. This suggests that many riders are using the service to access employment or to shop at the shopping centers on the western portion of the run, traveling west in the AM and back east in the PM. Westbound service has 18 riders on both the 8:00 AM and 10:00 AM trips, and subsequent trips have fewer riders until a small increase on the 6:00 PM trip. In the eastbound direction, ridership is fairly low in the morning, and gradually rises to 22 riders on the 2:25 PM and 19 riders on the 3:25 PM trip. Subsequent trips have less ridership.

FIGURE 10 – WESTBOUND WEEKDAY RIDERS PER TRIP

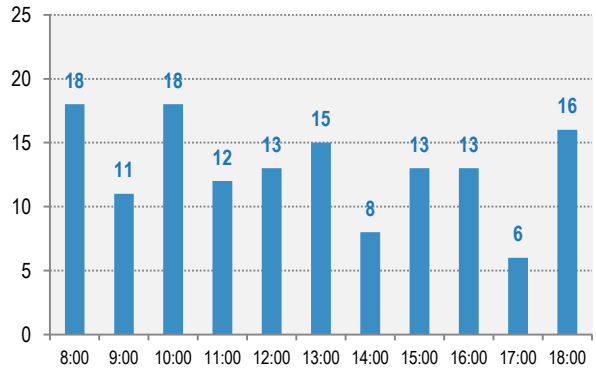
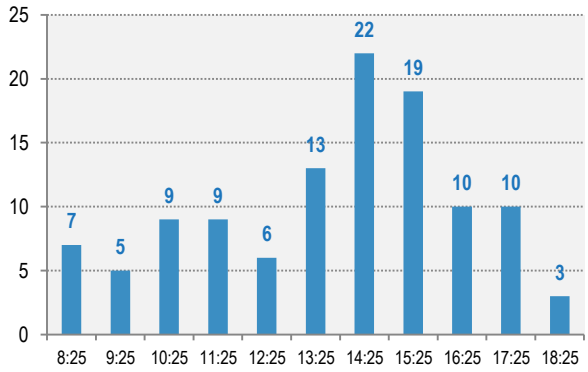


FIGURE 11 – EASTBOUND WEEKDAY RIDERS PER TRIP



Source: SEAT Ridecheck 2014

Performance. Overall, Run 12 performs slightly above average in terms of passengers per revenue hour. While the system averages 20.9 passengers per hour on weekdays and 16.4 per hour on Saturdays, Run 12 carries 23.3 and 23.6 passengers per revenue hour, respectively. The run carries a similarly high number of passengers per revenue mile on weekdays and Saturdays.

Although Run 12's on-time performance is above the systemwide average, over 35% of all trips do not arrive on time. This is partially due to the numerous turning movements that introduce the potential for delays along each trip. Additionally, the average speed of the run is below the systemwide average, which can partially be attributed to the use of local streets, but also due to the numerous turns in the run. Straightening the run thus could allow for a more attractive service at the same time increasing speed and on-time performance.

FIGURE 12 – PERFORMANCE MEASURES

Performance Measure	Weekday		Saturday		Sunday	
	Run 12	System Avg	Run 12	System Avg	Run 12	System Avg
Passengers per Revenue Vehicle Hour	23.3	20.9	23.6	16.4	-	12.9
Passengers per Revenue Vehicle Mile	2.4	1.6	2.4	1.2	-	0.8
Average Speed (mph)	9.7	16.2	9.7	15.2	-	17.6
On-Time Performance Reliability*	64.8%	57.9%	58.0%	52.8%	-	40.8%

*On-Time Performance is the percent of sampled observations where the bus arrived at timepoints within 5 minutes of the scheduled time.
Source: SEAT Analysis Factors 2014

FIGURE 13 – WEEKDAY RIDERS PER REVENUE HOUR

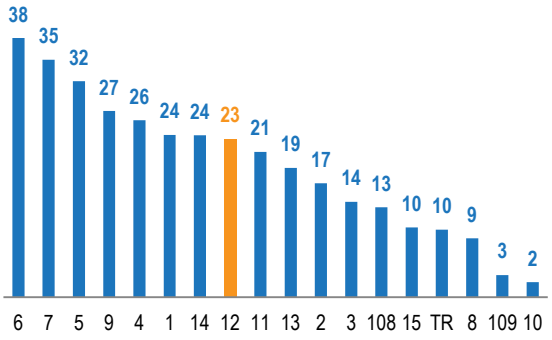
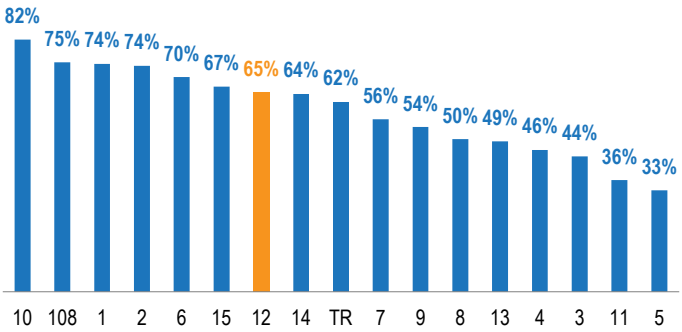


FIGURE 14 – WEEKDAY ON-TIME PERFORMANCE

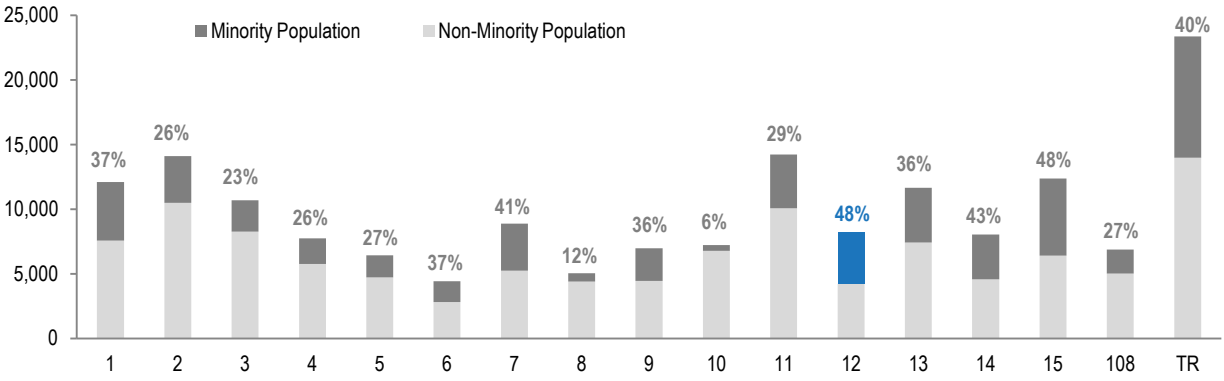


Source: SEAT Ridecheck 2014

Environmental Justice

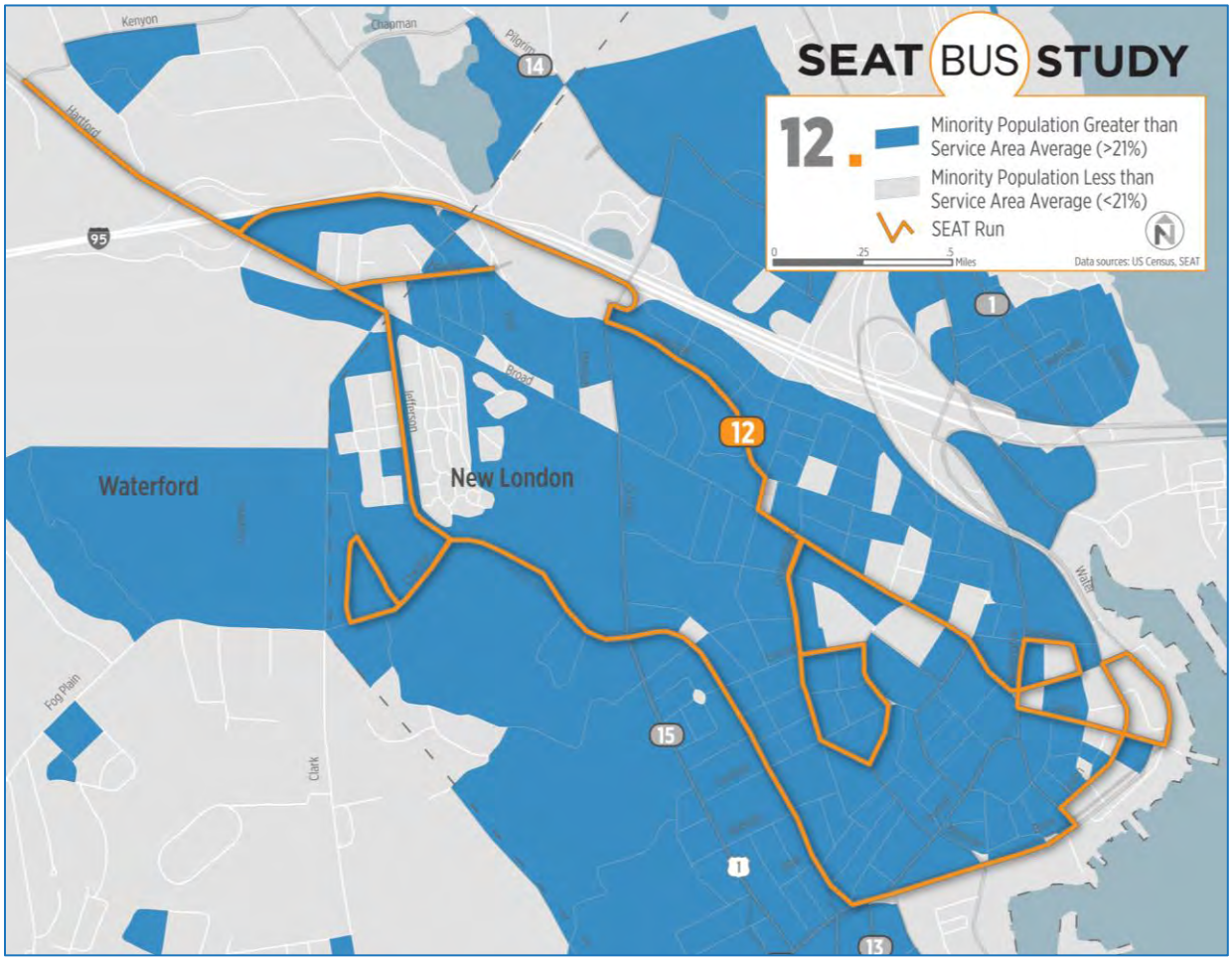
Run 12 predominately serves areas with a higher minority population than is found in the SEAT service area overall. Nearly half (48%) of the population served by Run 12 lives in census blocks that have a minority population greater than the overall service area average (21%). As shown in Figure 16, these minority populations are located throughout most of New London along almost the entirety of Run 12.

FIGURE 15 – SERVICE TO BLOCKS WITH HIGH MINORITY POPULATIONS



Sources: US Census 2010, SEAT

FIGURE 15 – MAP OF BLOCKS WITH HIGH MINORITY POPULATIONS



Sources: US Census 2010, SEAT

SERVICE IMPROVEMENT OPTIONS

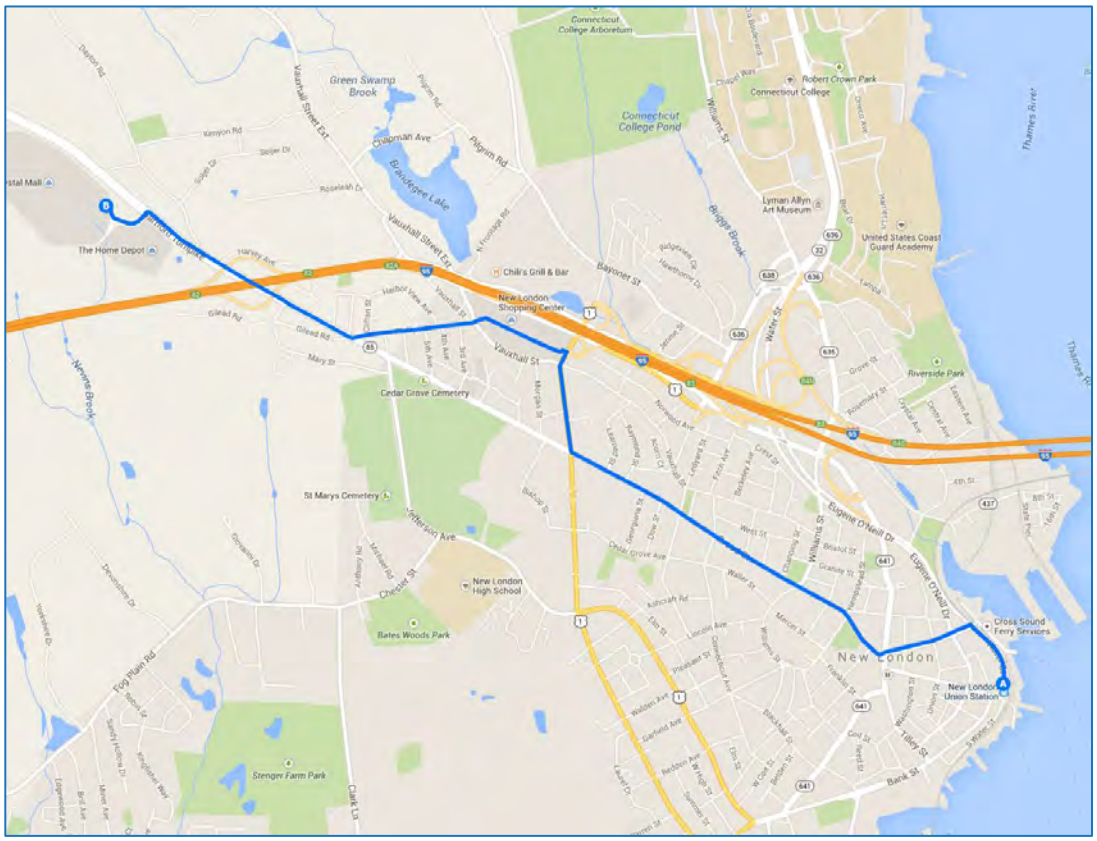
Run 12 is one of the primary runs providing service in New London and Waterford, and its productivity is fair. However, Run 12's circuitous and complex service alignment is confusing and difficult to understand and use, which deters potential riders from using the service. Also the looping pattern, designed to increase the geographic service coverage, makes service less attractive for riders. The single direction of service from the looping pattern means that although passengers may have a short trip on their first trip, they would have to ride through the entire loop on the return trip. This could result in travel times taking nearly as long as walking due to the long alignment and numerous deviations. Considering the run's strengths and weaknesses, some options to improve service on Run 12 include:

- **Eliminate deviations.** Deviations off of a main street are not only confusing, reduce average speeds, and negatively impact on-time performance of a run, they also add additional travel time for the majority of passengers riding through the deviation. Run 12's deviations could be eliminated in order to improve travel times for the overwhelming majority of riders on the run, improve on-time performance, improve the run's average speed, and greatly simplify service (see example in Figure 16).
  - For example, there are only 7 boardings and 5 alightings for the entire Chester Street deviation, forcing the 90 other passengers to sit through a loop. Most residential areas along

the deviation are within 1/3-mile of Jefferson Avenue (so most riders could walk to access service).

- Additionally, the deviation to serve Connecticut Avenue and Williams Street is also time consuming and causes inconvenience for other passengers. There are only 8 boardings and 10 alightings on these segments, while over 70 other passengers have to ride through the deviation. This deviation is also within close walking distance to both the Broad Street and Jefferson Avenue alignments.

FIGURE 16 – POSSIBLE ALIGNMENT



- **Eliminate New London loop.** The loop near the Holiday Inn on Governor Winthrop Boulevard in New London introduces additional delay, slows down service, and makes the run less attractive for passengers riding through. Eliminating this loop would make the run more attractive by simplifying its service alignment, reducing travel times, and reducing delay. In addition, the time savings achieved by converting to a simpler run alignment, in coordination with other time savings, could allow for more frequent service, an extension of the line, or simply better on-time performance.
- **Separate into two runs and provide bidirectional service.** Bidirectional transit service is usually preferred over one-way loop service because it provides more convenient service for riders. Run 12 could be split into two runs, each providing bidirectional service — one along the Jefferson Avenue and US-1/Colman Street corridor and the other along the Broad Street corridor. This would offer faster and more direct service for all passengers on the run. Careful consideration to scheduling and interlining would be necessary to avoid any disproportionately high increases in operation costs. Consolidation with Run 14, which provides service in several overlapping areas could be an option for bidirectional service.

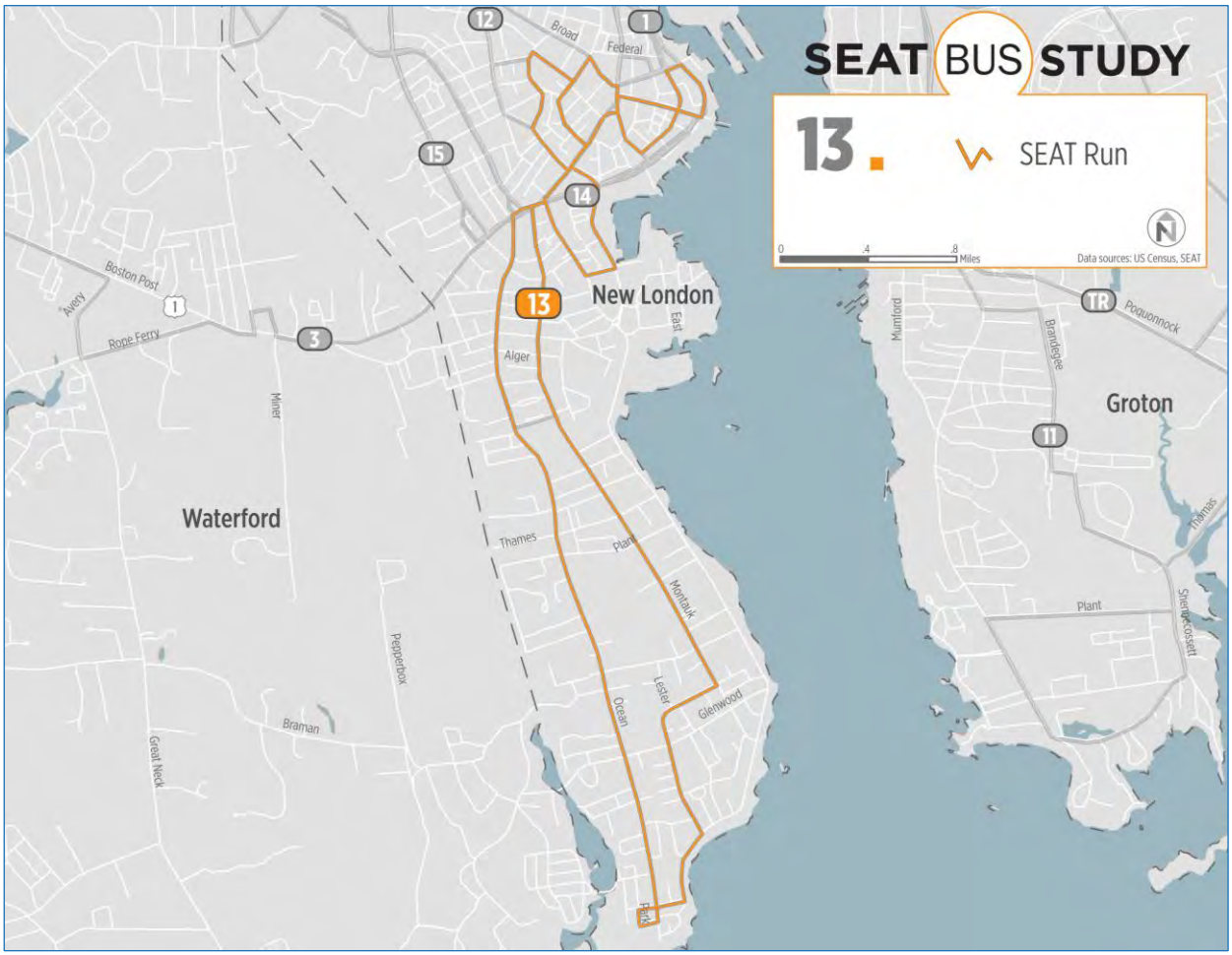
- **Improve circulation through New London Shopping Center.** Currently Run 12 serves the New London Shopping Center with a circuitous alignment that significantly slows through travel times. The alignment could be simplified by staying on Vauxhall Street and not deviating into the shopping center or the frontage road. Shopping center riders could board and alight at either Phillips Street or US-1/Colman Street, depending on which side of the shopping center they are visiting. This simplified alignment would likely cut a few minutes of travel time for those passengers riding through.
- **Redesign to serve a unique market.** Run 12 and Run 14 both serve very similar and overlapping markets, providing service between downtown New London, Crystal Mall, and neighborhoods in between. Run 12 could be redesigned in coordination with Run 14 to give each run a more clearly defined and unique market.

SERVICE EVALUATION

RUN 13 (SHAW'S COVE / L&M HOSPITAL / OCEAN BEACH)

Service Design. Run 13 operates between New London's Union Station hub and Ocean Beach Park. Its alignment contains several loops through the downtown area before proceeding on a more direct alignment to Ocean Beach Park. The run begins at Union Station, first loops via Water Street, Governor Winthrop Boulevard, and then back on Eugene O'Neill Drive. The run then proceeds south on Green Street, then north on Huntington Street, west on Jay Street, before doing another loop on Hempstead Street, Williams Street, Blackhall Street, and then south on Binman Street. Another deviation to serve several businesses at Shaw's Cove is made via Howard Street, Hamilton Street, and then Shaw Street before returning back to a straighter alignment to Ocean Beach. Southbound, the run operates via Montauk Avenue to Lower Boulevard, and then Pequot Avenue before terminating at Ocean Beach Park. Northbound, the service operates via Ocean Avenue, to Bank Street, then northeast on Truman Street. The run does one last deviation to serve Hempstead Street, Broad Street, and then State Street before returning to the New London Union Station.

FIGURE 1 – RUN MAP



Service Schedule. Unlike its complex alignment, Run 13's schedule is fairly simple, operating every 60 minutes. On weekdays, service begins at 7:00 AM and ends at 6:30 PM, while on Saturday, service begins at 8:00 AM and ends at 6:30 PM. There is no Sunday service.

FIGURE 2 – SCHEDULE STATISTICS

Service Day	Span of Service	Frequency (min) Peak / Off-Peak	Daily Trips
Weekday	7:00 AM — 6:30 PM	60	24
Saturday	8:00 AM — 6:30 PM	60	22
Sunday	-	-	-

Source: SEAT Run Schedules

Interaction with System. Run 13 serves New London's Union Station hub, which is a major transfer point to other local and regional SEAT services. Since many of the connections are timed at Union Station, transferring at other locations would not likely offer any significant time savings. In addition to this transfer point, the run interacts with other bus runs at the following places:

- Run 12 also provides a deviation to serve the Williams Street area between Blackhall Street and Lincoln Avenue.
- Runs 3 and 14 also serve shared segments along Bank Street.
- Run 15 provides evening service on some portions of the run, including Montauk Avenue and Ocean Avenue between Bank Street and Fair Harbour Place.

Ridership by Service Day. On average, Run 13 performs below the systemwide ridership in terms of both aggregate ridership and ridership per trip. Run 13 carries 228 passengers per weekday and 145 passengers per Saturday. Run 13 thus carries an average of 9.5 passengers per weekday trip and 6.6 per Saturday trip, which is well below the systemwide averages of 13.0 and 9.5 riders, respectively.

FIGURE 3 – RIDERSHIP STATISTICS

Service Day	Daily Ridership	Ridership per Trip	
	Run 13	**Run 13**	**System Avg**
Weekday	228	9.5	13.0
Saturday	145	6.6	9.5
Sunday	-	-	5.8

Source: SEAT Ridecheck 2014

FIGURE 4 – AVERAGE WEEKDAY RIDERSHIP

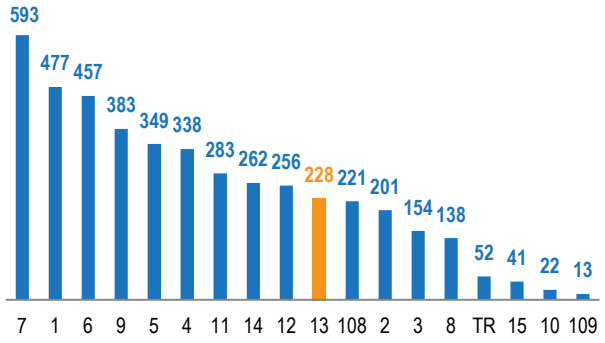
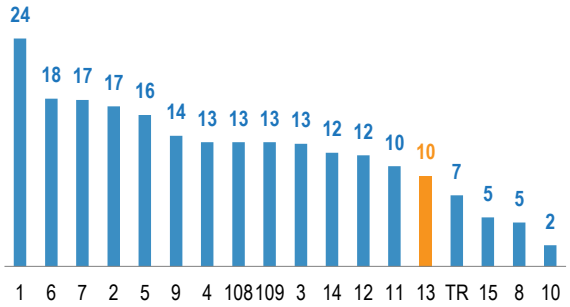


FIGURE 5 – AVERAGE WEEKDAY RIDERSHIP PER TRIP

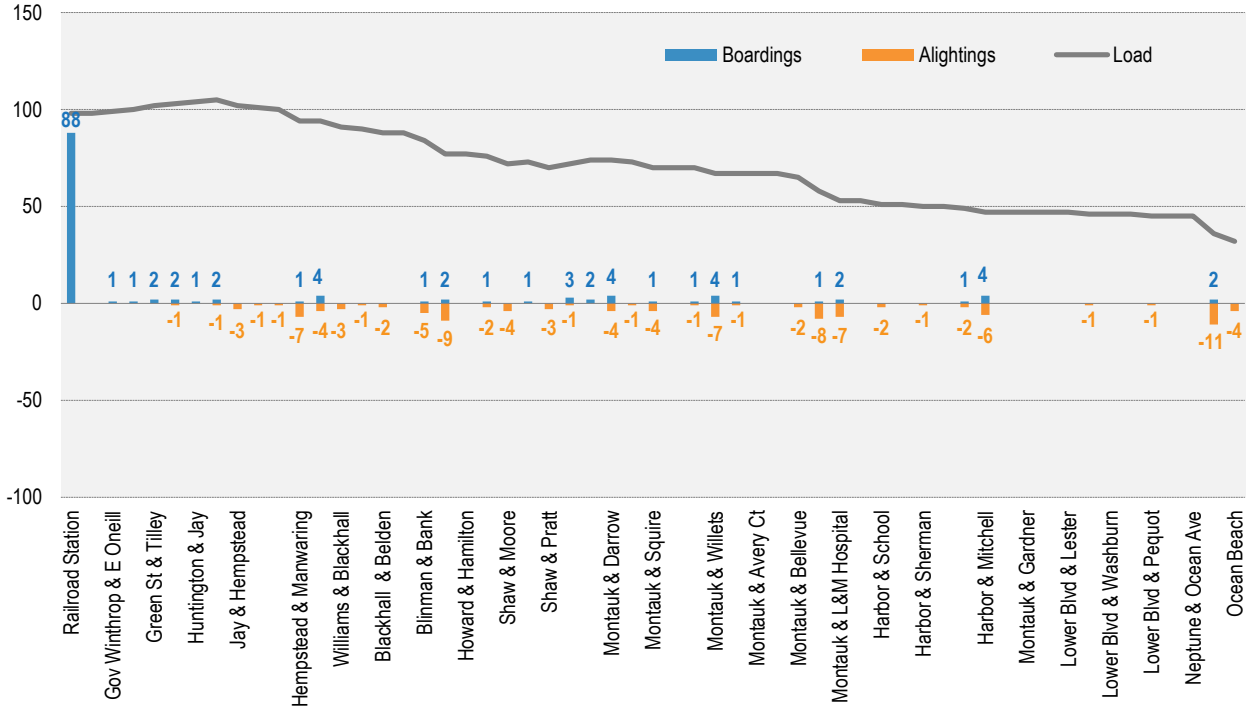


Source: SEAT Ridecheck 2014

Ridership by Stop. The vast majority of boardings and alightings along this run occur at New London's Union Station hub (88 boardings and 63 alightings). Outside of this stop, there are no other places that have ridership activity to the same degree, with Figures 6 and 7 showing that Run 3 collects and drops off passengers nearly equally along the entire run. Some places that have somewhat higher ridership activity compared to others include:

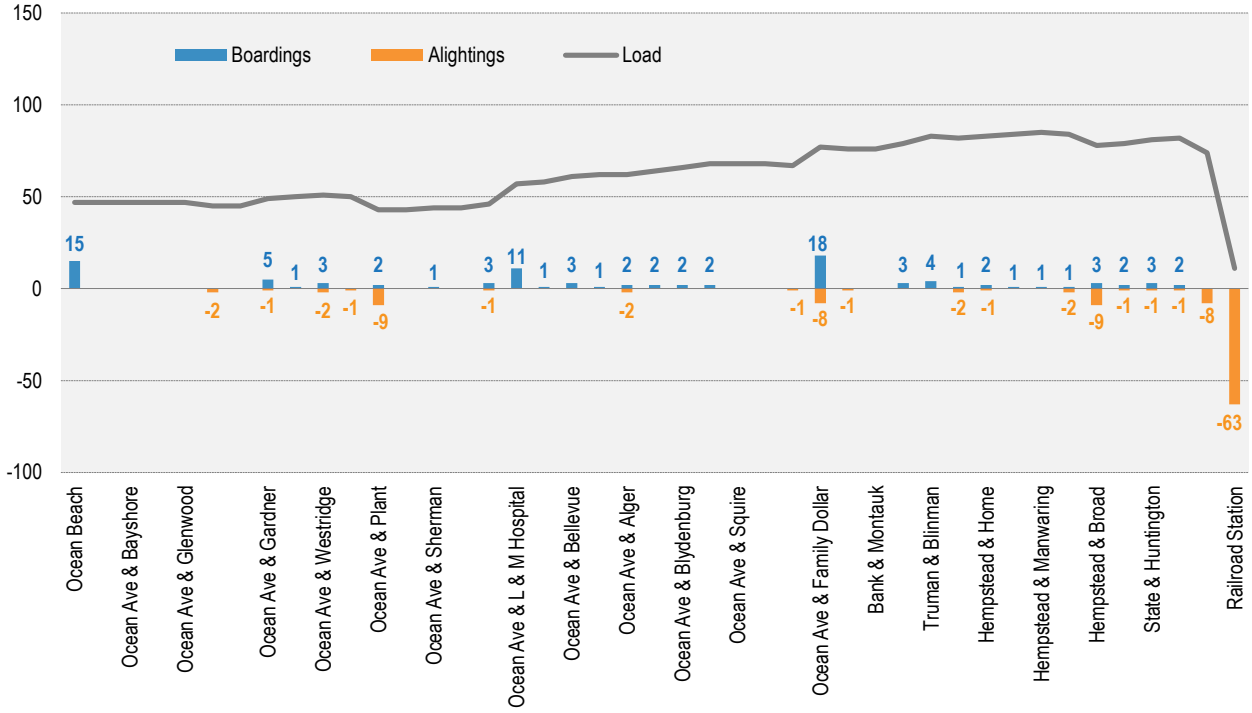
- **Ocean Avenue Family Dollar (Darrow Street)** has a total of 18 northbound boardings and 8 alightings.
- **Ocean Beach.** The terminus of the line has 15 boardings and 4 alightings. 57 passengers stay on when the run switches directions, most likely due to the one-way alignment.
- **Lawrence Memorial Hospital.** On Montauk Avenue, a total of 15 alightings occur near the hospital, and on 14 boardings near the hospital on Ocean Avenue. This is the highest ridership section outside of central New London.
- **Ocean Avenue at Plant Street (northbound)** has 9 alightings but only 2 boardings.
- **Hempstead at Broad Street** has 9 alightings in the northbound direction.
- **Howard Street at Shaw's Cove** has 9 alightings in the southbound direction.

FIGURE 6 – SOUTHBOUND WEEKDAY RIDERSHIP BY STOP CHART



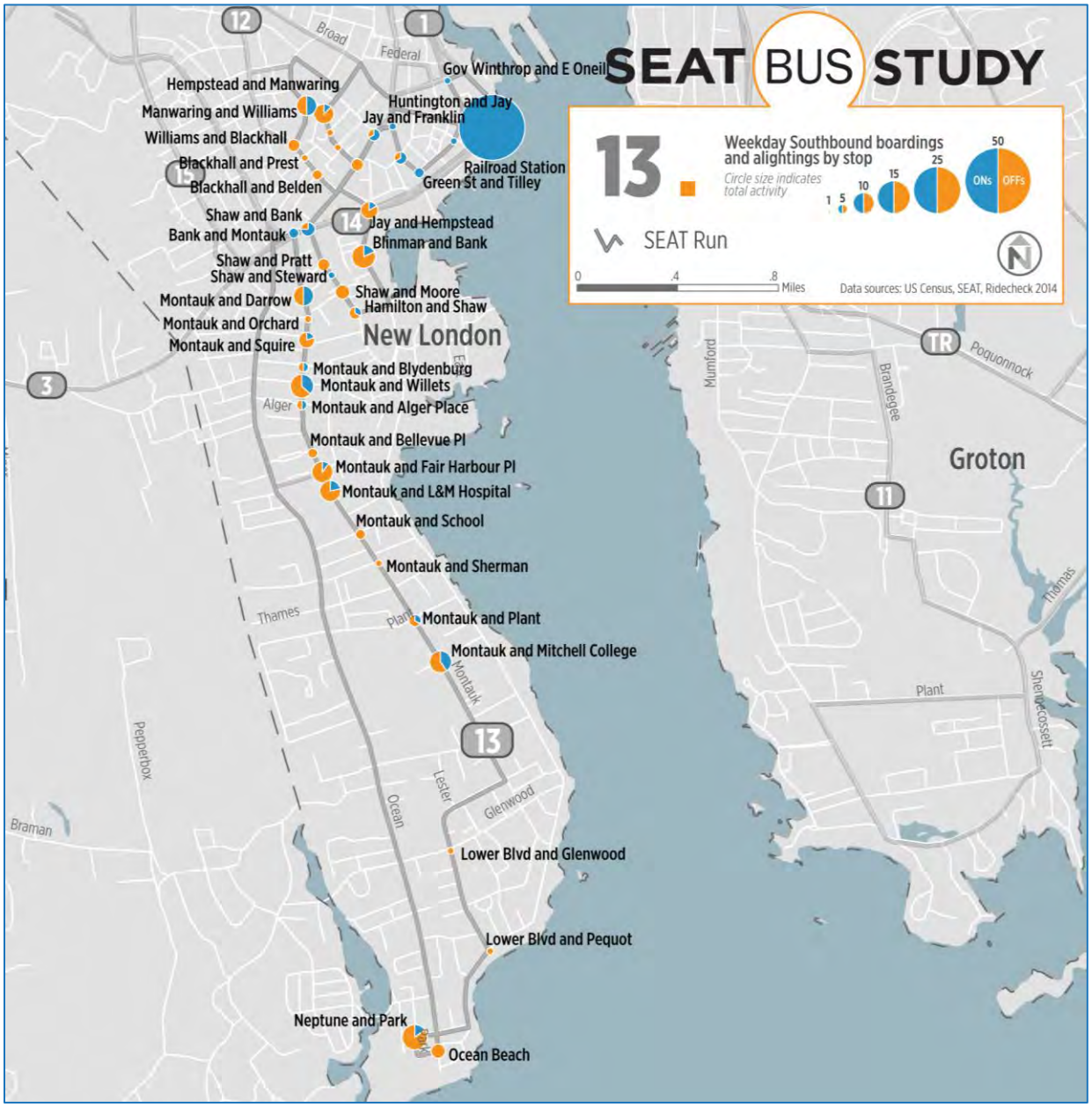
Source: SEAT Ridecheck 2014

FIGURE 7 – NORTHBOUND WEEKDAY RIDERSHIP BY STOP CHART



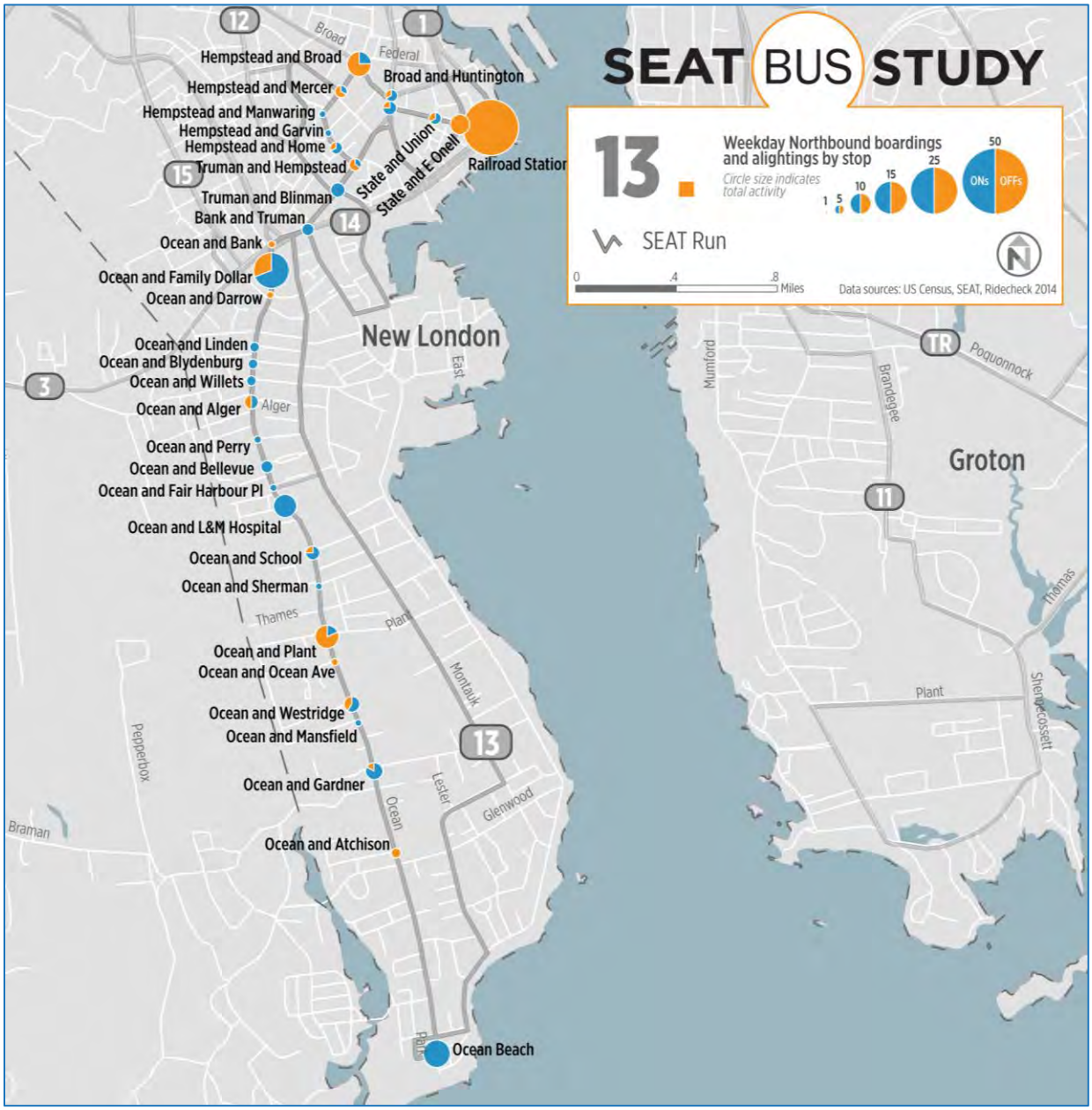
Source: SEAT Ridecheck 2014

FIGURE 8 – SOUTHBOUND WEEKDAY RIDERSHIP BY STOP MAP



Source: SEAT Ridecheck 2014

FIGURE 9 – NORTHBOUND WEEKDAY RIDERSHIP BY STOP MAP



Source: SEAT Ridecheck 2014

Ridership by Trip. Ridership on Run 13 follows the traditional peak patterns, with most passengers traveling towards central New London in the morning and then returning southbound in the afternoon. In the northbound direction, the first two trips have the most ridership (16 and 14 riders), followed with declining ridership per trip throughout the rest of the day. In contrast, the southbound ridership in the morning is low, gradually increasing towards the afternoon. The most riders in the afternoon are at 3:00 PM and 4:00 PM (18 and 15 riders respectively).

FIGURE 10 – SOUTHBOUND WEEKDAY RIDERS PER TRIP

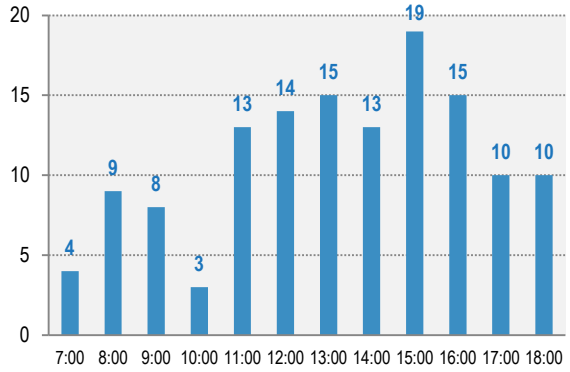
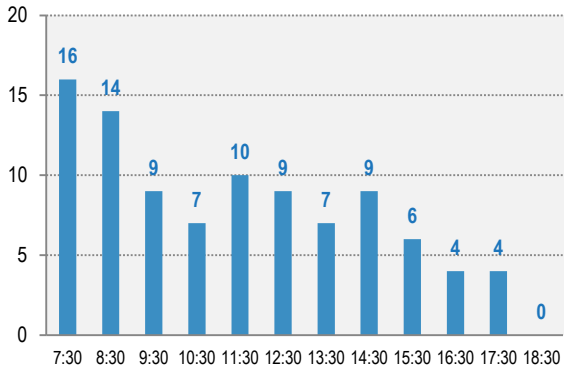


FIGURE 11 – NORTHBOUND WEEKDAY RIDERS PER TRIP



Source: SEAT Ridecheck 2014

Performance. Run 13 performs slightly below average on several levels compared to the system as a whole. Its weekday ridership per revenue hour at 19.0 is only slightly below the system average of 20.9., Saturday trips average 13.2 passengers per hour compared to 16.4 on the system level. On-time performance for weekday trips is below the system average (likely due to weekday traffic congestion), but for Saturday trips exceeds the system average. Due to Run 13's primarily urban run, its average speeds are also below the systemwide average. Furthermore, the number of turning movements, deviations and loops are likely contributors to the number of delays and low operating speed. Thus, a straighter alignment could improve the run's performance.

FIGURE 12 – PERFORMANCE MEASURES

Performance Measure	Weekday		Saturday		Sunday	
	Run 13	System Avg	Run 13	System Avg	Run 13	System Avg
Passengers per Revenue Vehicle Hour	19.0	20.9	13.2	16.4	-	12.9
Passengers per Revenue Vehicle Mile	1.8	1.6	1.2	1.2	-	0.8
Average Speed (mph)	10.6	16.2	10.6	15.2	-	17.6
On-Time Performance Reliability*	49.0%	57.9%	60.2%	52.8%	-	40.8%

*On-Time Performance is the percent of sampled observations where the bus arrived at timepoints within 5 minutes of the scheduled time.
Source: SEAT Analysis Factors 2014

FIGURE 13 – WEEKDAY RIDERS PER REVENUE HOUR

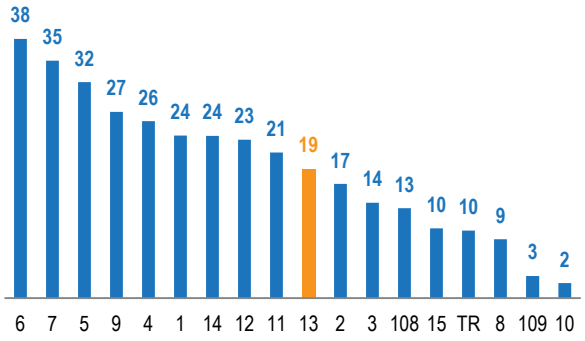
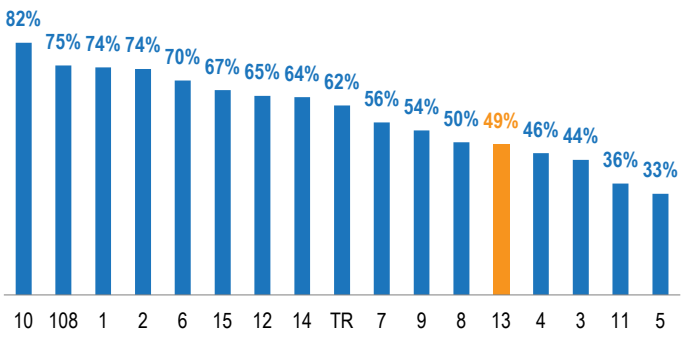


FIGURE 14 – WEEKDAY ON-TIME PERFORMANCE

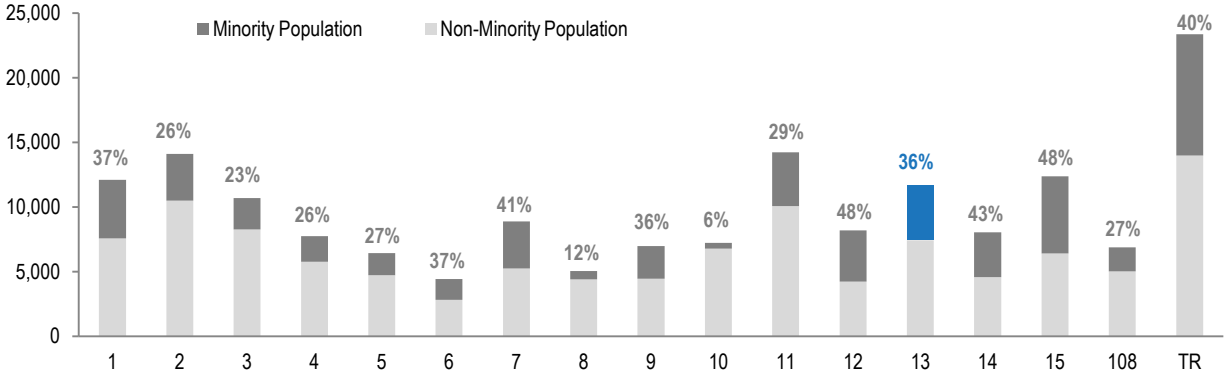


Source: SEAT Ridecheck 2014

Environmental Justice

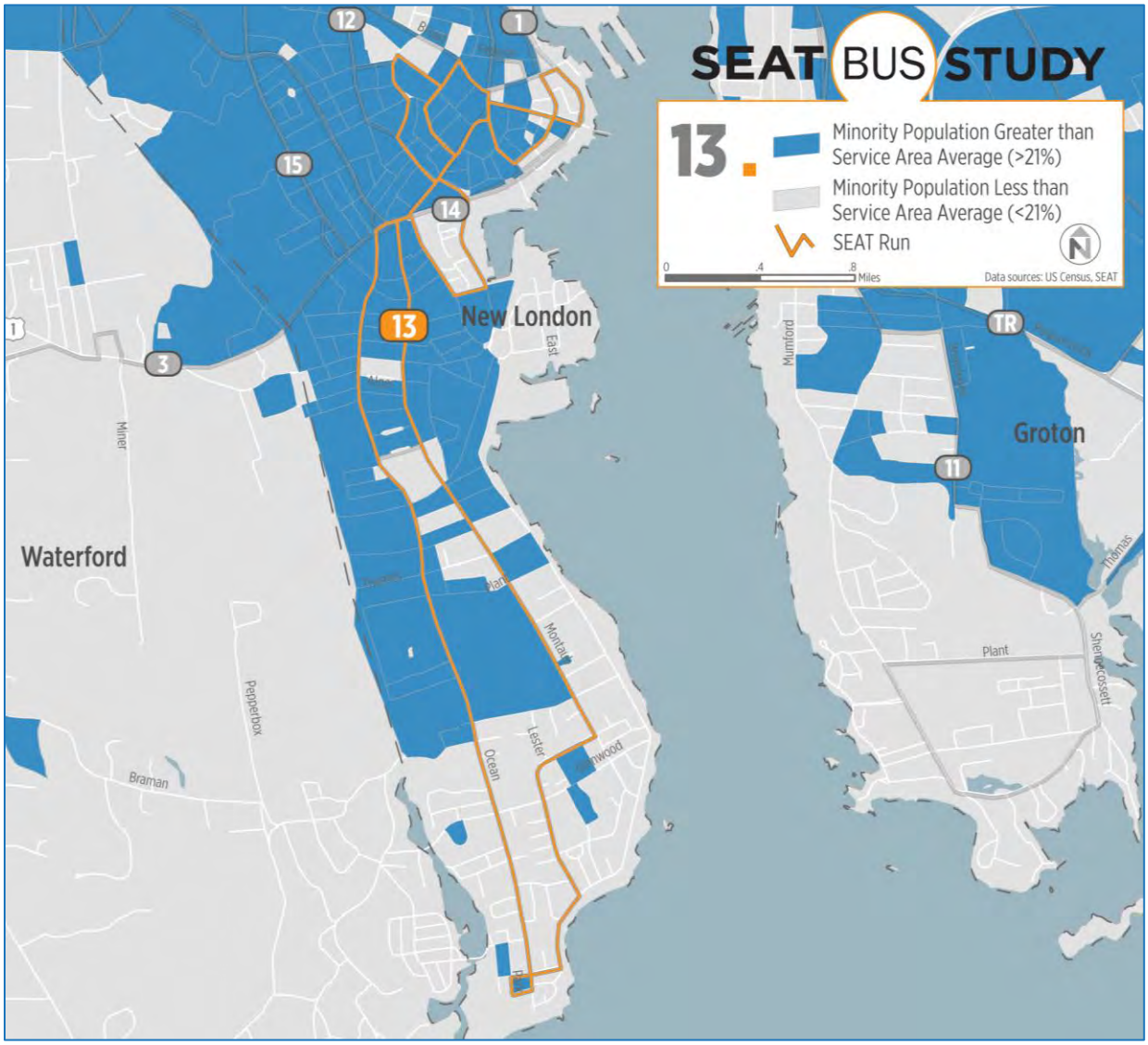
Run 13 predominately serves areas with a slightly higher minority population than is found in the SEAT service area overall. More than one-third (36%) of the population served by Run 13 lives in census blocks that have a minority population greater than the overall service area average (21%). As shown in Figure 16, these minority populations are concentrated in downtown New London and along Ocean Avenue as far south as Niles Hill Road.

FIGURE 15 – SERVICE TO BLOCKS WITH HIGH MINORITY POPULATIONS



Sources: US Census 2010, SEAT

FIGURE 16 – MAP OF BLOCKS WITH HIGH MINORITY POPULATIONS



Sources: US Census 2010, SEAT

SERVICE IMPROVEMENT OPTIONS

Run 13 is an urban radial run serving the southern neighborhoods of New London. It is a relatively short run serving high-density areas, but performs slightly below average in terms of ridership productivity. This is likely due to the number of deviations, turning movements, and loops in the run's alignment, which affect on-time performance and the overall attractiveness of the service.

Another consideration is that Runs 3, 12, 13, 14 and 15 combined offer high levels of service to New London but share similar alignments:

Opportunities to improve service on this run include:

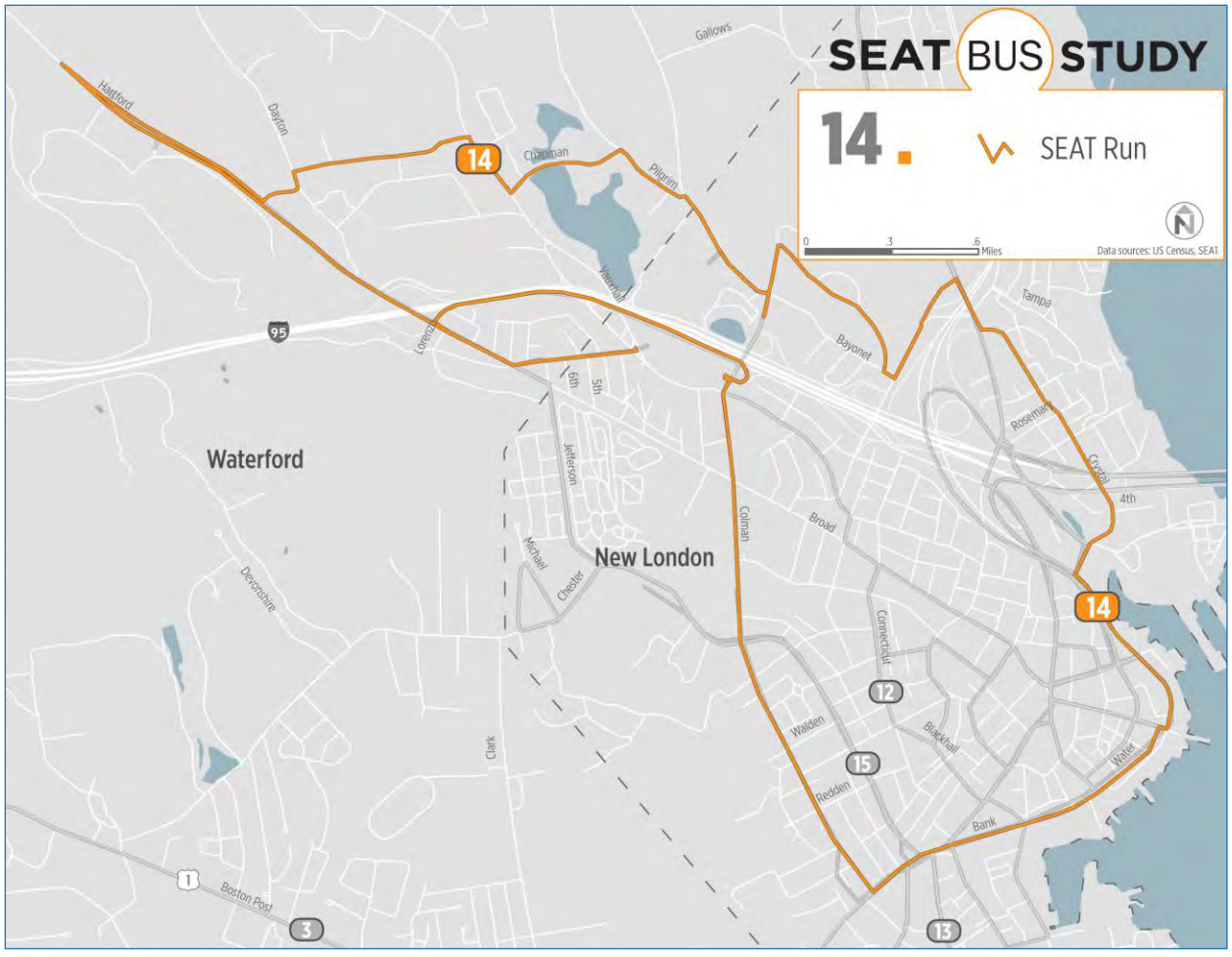
- **Simplify and streamline the alignment in central New London.** The loops in downtown are difficult for the rider to interpret and are time-consuming. Simplifying the alignment would speed up the journey for many riders and increase the attractiveness of the service. In addition, many of the deviations are in close walking distance to a major street, and thus eliminating such portions of the alignment would have little hardship on riders, especially if it improves overall trip times.
- **Better coordinate alignments of Runs 12, 13, 14, 15:** Downtown New London services share similar alignments, particularly along Bank Street. Additionally, Run 15 parallels Run 13 along Montauk/Ocean as far south as Fair Harbour Place. Although one-way streets make some duplication inevitable, these services could be realigned to more directly serve unique markets and provide better coverage.
- **Consider local circulator run:** Many of the downtown New London services have deviations through downtown and the adjoining neighborhoods. Eliminating these deviations and keeping radial runs on main roads would provide faster, more convenient service for most riders. Local circulator service in New London's downtown neighborhoods could be designed to replace these deviations.
- **Operate service south of Bank Street on same alignment:** Southbound service operates via Montauk Avenue and northbound service operates via Ocean Avenue. Although Mitchell College is located on Montauk, there is more residential housing along and just off of Ocean Avenue and a two-way alignment would make the service more attractive to these residents. Montauk Avenue residents would be a $^{2}/_{5}$-mile from the service at Gardner Avenue and Ocean Avenue, and only ¼-mile (or a 5 minute walk) from Thames Street and Ocean Avenue.
- **Turn buses at Gardner Avenue in the wintertime:** With the exception of the last stop at Ocean Park, there is minimal ridership south of Gardner Avenue. This ridership data is from the fall of 2014, and does not incorporate summertime ridership, which is likely higher as people use Run 13 to get to the beach. However, a "short turn" at Gardner Avenue would make this service more productive overall.

SERVICE EVALUATION

RUN 14 (NEW LONDON MALL / WATERFORD COMMONS / CRYSTAL MALL / NL SHOPPING)

Service Design. Run 14 operates in a large counter-clockwise loop throughout New London and Waterford, serving New London Union Station and several shopping centers. Service begins at New London Union Station, proceeds north on Water Street and then Crystal Avenue. Run 14 then turns south on Briggs Street, turning west on Bayonet Street to serve the New London Mall, continuing on Pilgrim Road, then west on Chapman Avenue crossing Brandegee Lake. The run proceeds north on Vauxhall Street Extension, then west on Kenyon Road, and Dayton Road, arriving at the Crystal Mall. Run 14 then serves the Waterford Commons Shopping Center via Route 85/Hartford Turnpike before switching directions. The run returns to Crystal Mall on Hartford Turnpike, then to New London Shopping Center via Broad Street and Phillips Street. The run then retraces on Phillips Street, Broad Street before proceeding northwest on South Frontage Road, circling behind the shopping center, then proceeding south on Colman Street until Bank Street. The run then uses Bank Street to return to New London Union Station.

FIGURE 1 – RUN MAP



Service Schedule. Run 14 operates with a fairly simple schedule with service every 60 minutes. On both weekdays and Saturday, service begins at 8:00 AM and ends at 6:25 PM. There is no Sunday service.

FIGURE 2 – SCHEDULE STATISTICS

Service Day	Span of Service	Frequency (min) Peak / Off-Peak	Daily Trips
Weekday	8:00 AM — 6:25 PM	60	22
Saturday	8:00 AM — 6:25 PM	60	22
Sunday	-	-	-

Source: SEAT Run Schedules

Interaction with System. Run 14 serves New London Union Station, which provides transfers to several other regional and local runs in the SEAT system. In addition, Run 14 interacts with the following runs:

- Run 12 provides service to similar service areas south of I-95, however, it operates in the opposite direction. Run 12 provides clockwise service on Jefferson Street, which is one block away from Colman Street. Run 12 also provides service to the New London Shopping Center and the Crystal Mall.
- Run 13 provides some overlap service near Bank Street, however is much more circuitous, deviating north and south of Bank Street.
- Run 15 provides evening service on several portions of the run. Specifically, Run 15 overlaps Run 14 on Hartford Turnpike, Broad Street, and Phillips Street (serving New London Shopping Center, Crystal Mall, and Waterford Commons), and Colman Street. The run also operates in close proximity to Run 14's Bank Street alignment in downtown.

Ridership by Service Day. Run 14 ranks near the median in terms of total passengers per day, however, of the New London local runs, it does slightly better than the others (see Figure 4). On weekdays, the run carries an average of 262 passengers, which is an average of 11.9 passengers per trip (see Figure 3). This is slightly below the systemwide average of 13.0 riders per trip (se Figure 5). On Saturday, there are 188 riders (29% less passengers compared to the run's weekday service), which averages 8.5 passengers per trip, also slightly less than the systemwide average of 9.5 riders.

FIGURE 3 – RIDERSHIP STATISTICS

Service Day	Daily Ridership	Ridership per Trip	
	Run 14	**Run 14**	**System Avg**
Weekday	262	11.9	13.0
Saturday	188	8.5	9.5
Sunday	-	-	5.8

Source: SEAT Ridecheck 2014

FIGURE 4 – AVERAGE WEEKDAY RIDERSHIP

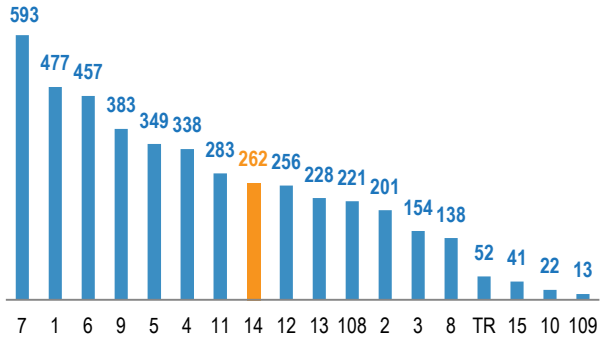
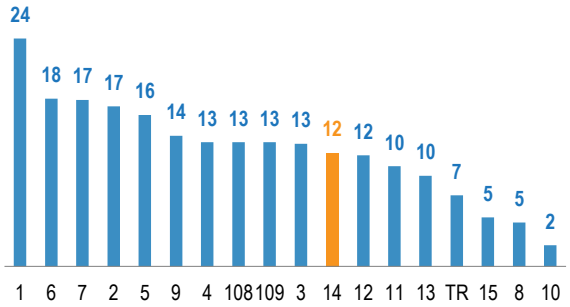


FIGURE 5 – AVERAGE WEEKDAY RIDERSHIP PER TRIP



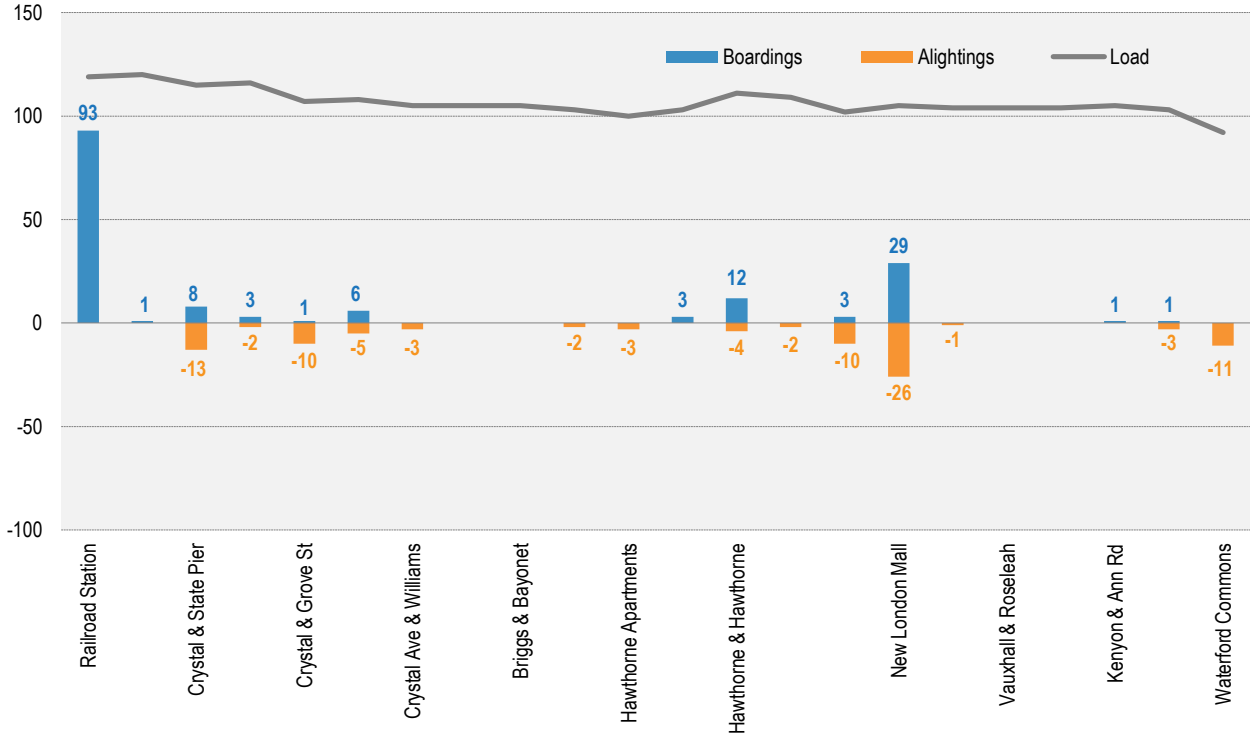
Source: SEAT Ridecheck 2014

Ridership by Stop. Ridership is mostly concentrated at the New London Union Station and the shopping centers along the run. Outside of these locations, most stops have few riders, but as a whole make up a large percentage of total ridership. This indicates that many people are likely using this run for travel between the neighborhoods and the New London Union Station and shopping centers. Important areas of ridership activity include:

- **New London Union Station.** This stop has the highest ridership on Run 14, with 93 daily boardings and 52 daily alightings. This is a major transfer point to other SEAT services as well as for rail service throughout New England.
- **New London Mall.** This stop has 29 daily boardings and 26 daily alightings.
- **New London Shopping Center** has 28 daily boardings and 30 daily alightings.
- **Crystal Mall** is an important regional retail center, but Run 14 serves fewer passengers here compared to the other shopping centers on the run, with only 19 daily boardings and 18 daily alightings.
- **Colman & Walden** is in close proximity to clusters of low-income and New London Housing Authority units, and has 16 boardings and 9 alightings.

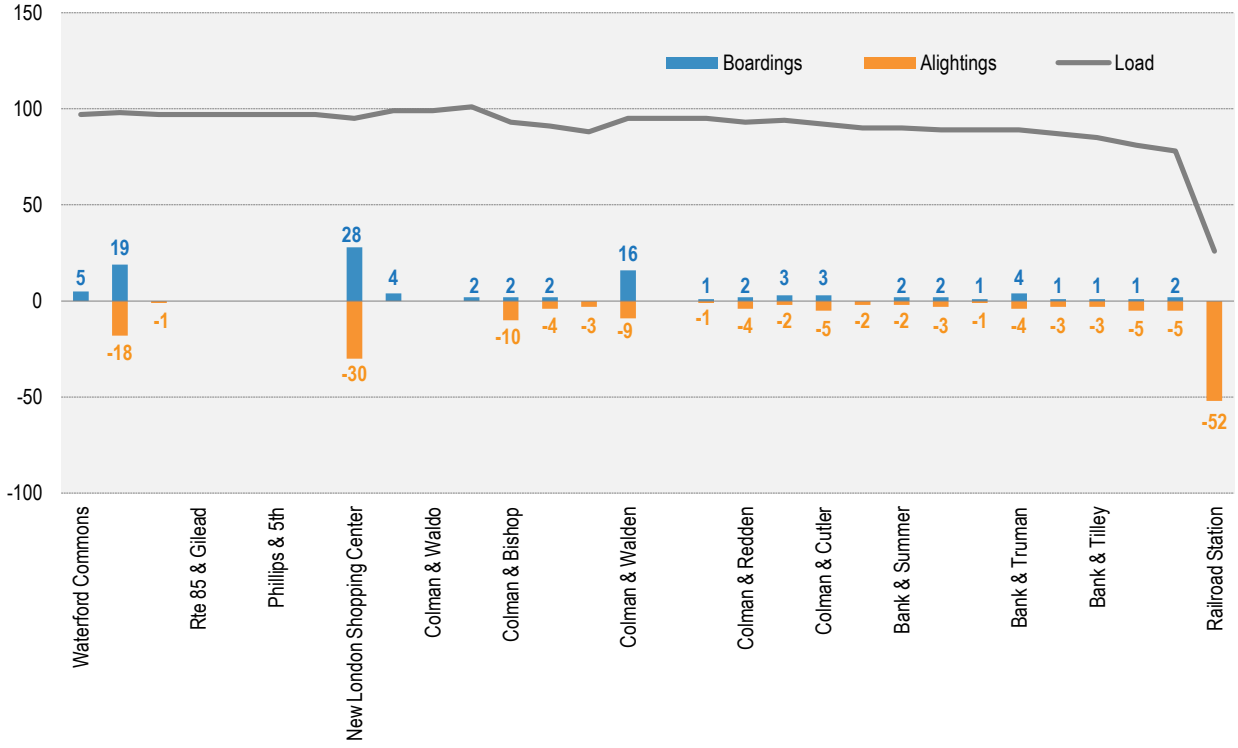
Because of Run 14's alignment as a large one-way loop, many riders stay on when the run switches direction. Therefore, the load onboard the vehicle hovers around 100 passengers consistently for most of the run. There is significant turnover at the New London Union Station, however, as only 26 passengers stay onboard through this stop.

FIGURE 6 – WESTBOUND WEEKDAY RIDERSHIP BY STOP CHART



Source: SEAT Ridecheck 2014

FIGURE 7 – EASTBOUND WEEKDAY RIDERSHIP BY STOP CHART



Source: SEAT Ridecheck 2014

FIGURE 8 – WESTBOUND WEEKDAY RIDERSHIP BY STOP MAP

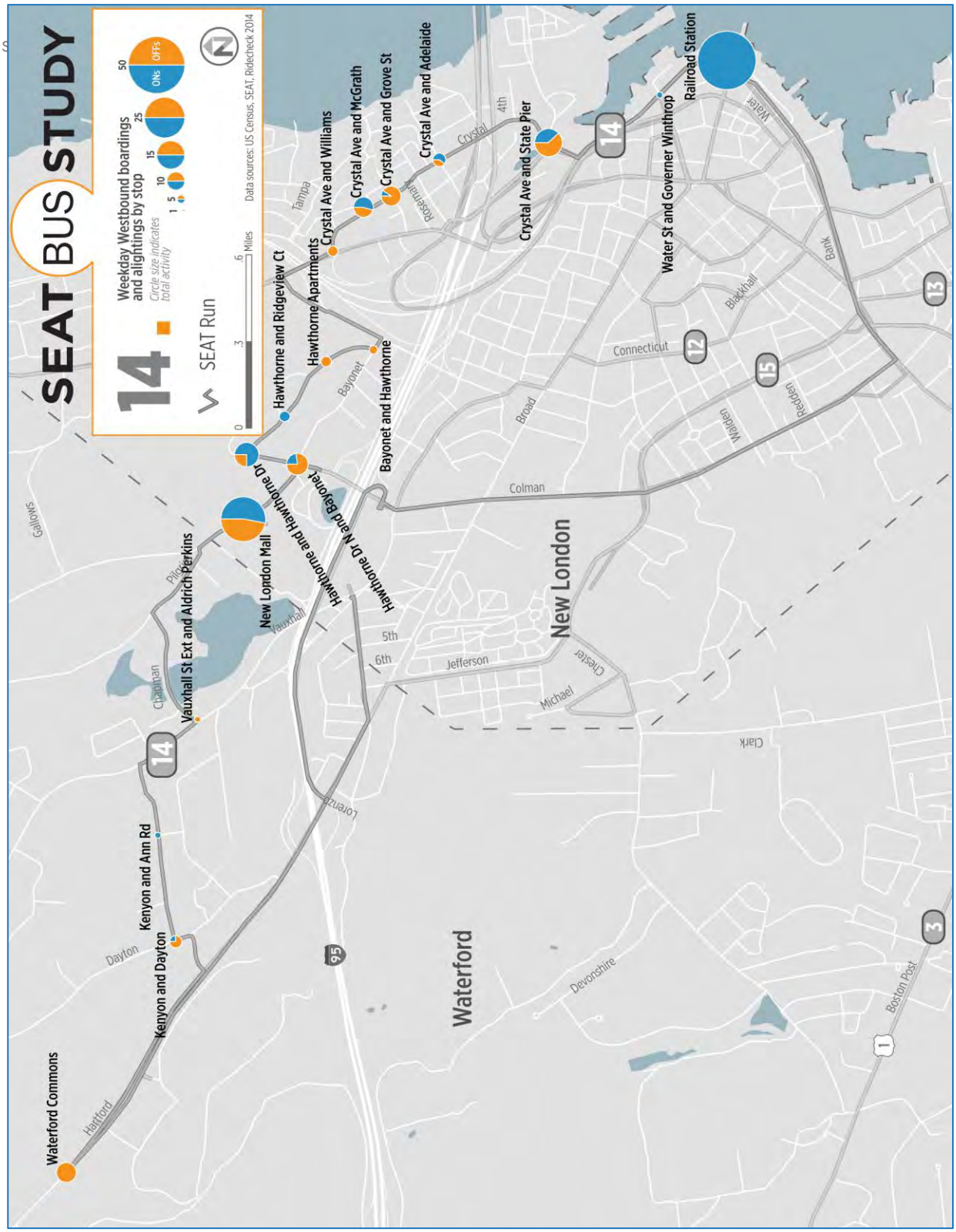
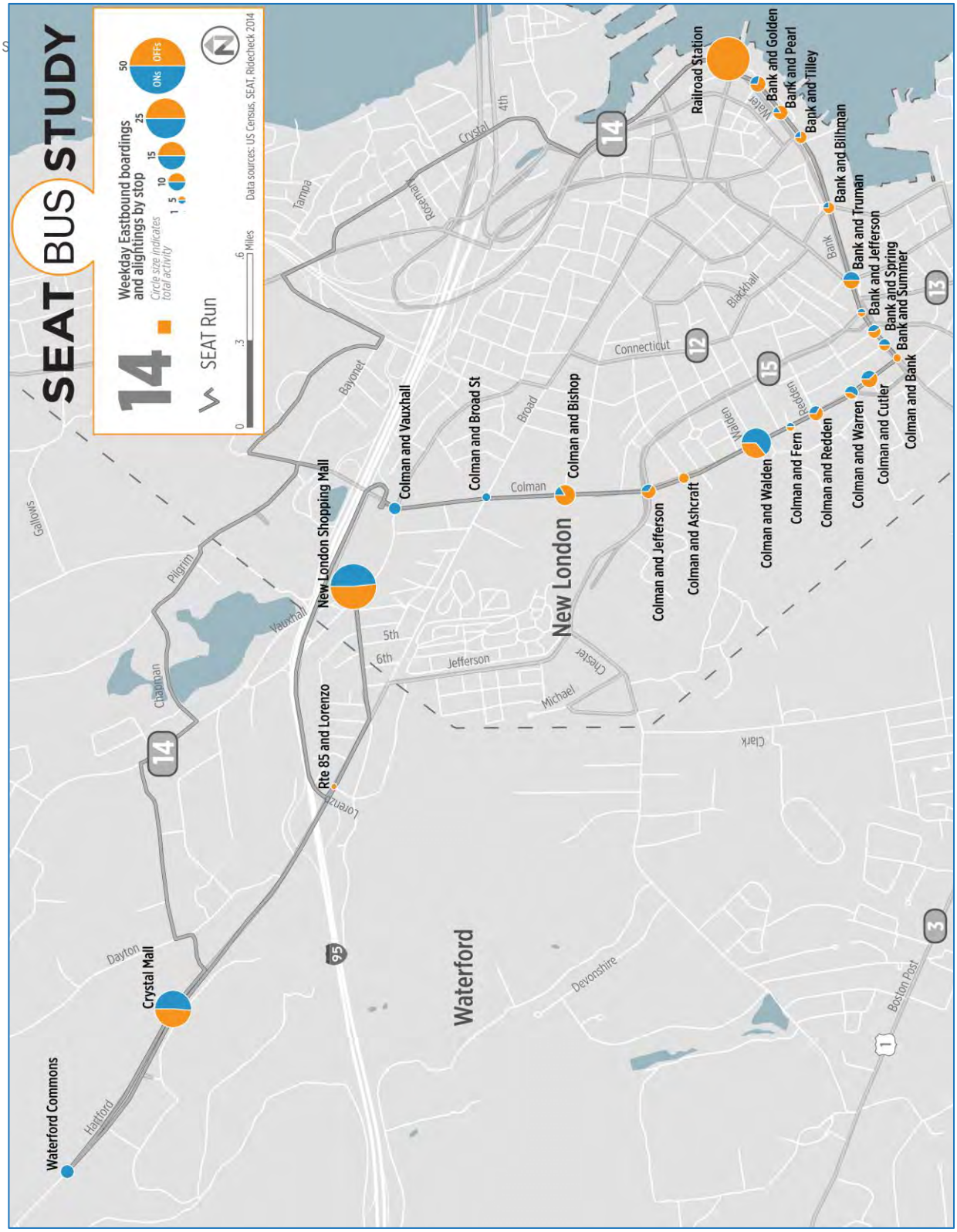


FIGURE 9 – EASTBOUND WEEKDAY RIDERSHIP BY STOP MAP



Ridership by Trip. Run 14's ridership is highest during the midday and does not reflect the traditional surges in ridership in the morning and afternoon peaks. This indicates that the run does not serve a large commuter market and a large number of riders are using the service to access the malls along the run, likely to run errands or to shop.

Ridership in both directions gradually increases throughout the day, peaking between 12:00 PM and 2:00 PM, and then gradually decreasing. In the northbound direction, the highest ridership trips are at 12:00 PM, 2:00 PM, and 3:00 PM, which all have 20 or more passengers. In the eastbound direction, the 12:25 PM and 1:25 PM trips have at least 15 riders.

FIGURE 10 – WESTBOUND WEEKDAY RIDERS PER TRIP

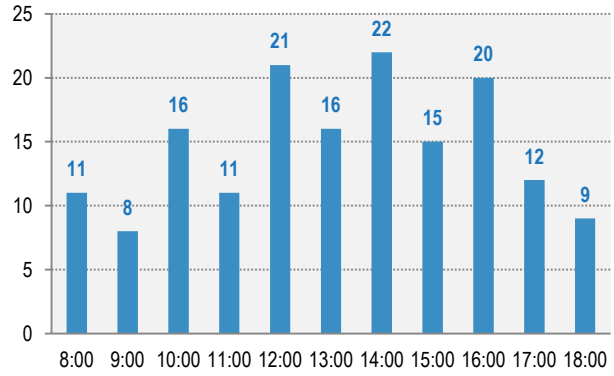
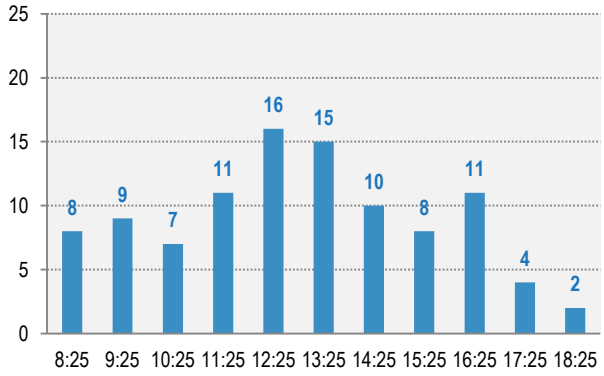


FIGURE 11 – EASTBOUND WEEKDAY RIDERS PER TRIP



Source: SEAT Ridecheck 2014

Performance. Run 14 performs slightly above the systemwide average on most performance measures, with 23.8 passengers per revenue hour (compared to 20.9 systemwide) on weekdays, and 17.1 on weekdays (compared to 16.4 systemwide). Run 14 suffers from a slow average speed, largely due to the complicated alignment that introduces turning delays. Like several other runs in the system, Run 14 suffers from poor on-time performance, despite being above the systemwide average, with over 35% of all weekday and 59% of all Saturday trips arriving late (also exacerbated by the complicated alignment). Saturday's poor on-time performance may be due to traffic congestion, irregular driver behavior, or an unusually late trip on the sampled day.

FIGURE 12 – PERFORMANCE MEASURES

Performance Measure	Weekday		Saturday		Sunday	
	Run 14	System Avg	Run 14	System Avg	Run 14	System Avg
Passengers per Revenue Vehicle Hour	23.8	20.9	17.1	16.4	-	12.9
Passengers per Revenue Vehicle Mile	2.1	1.6	1.5	1.2	-	0.8
Average Speed (mph)	11.2	16.2	11.2	15.2	-	17.6
On-Time Performance Reliability*	64.4%	57.9%	40.9%	52.8%	-	40.8%

*On-Time Performance is the percent of sampled observations where the bus arrived at timepoints within 5 minutes of the scheduled time.
Source: SEAT Analysis Factors 2014

FIGURE 13 – WEEKDAY RIDERS PER REVENUE HOUR

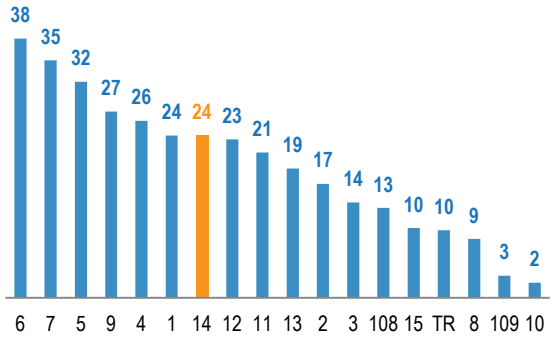
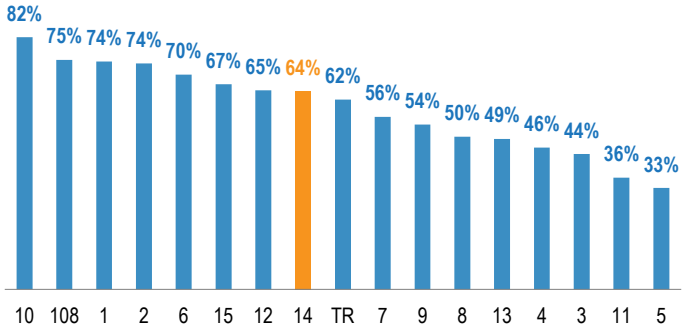


FIGURE 14 – WEEKDAY ON-TIME PERFORMANCE

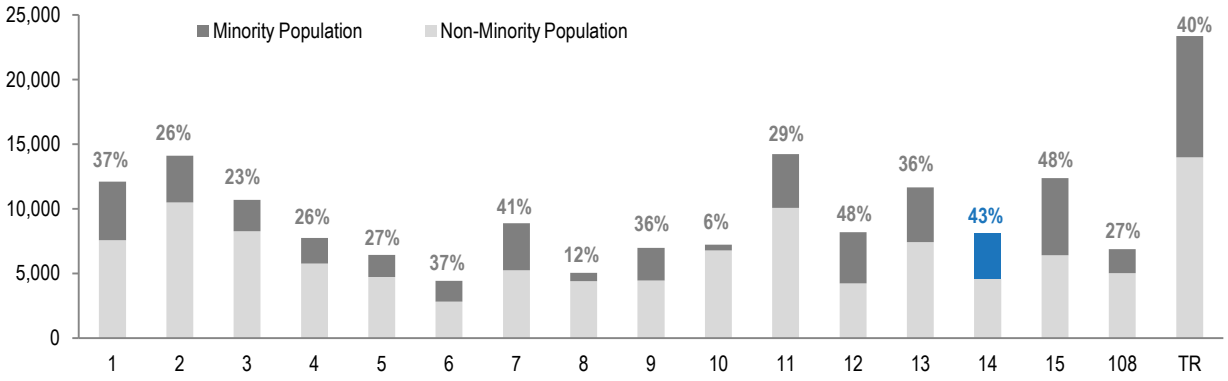


Source: SEAT Ridecheck 2014

Environmental Justice

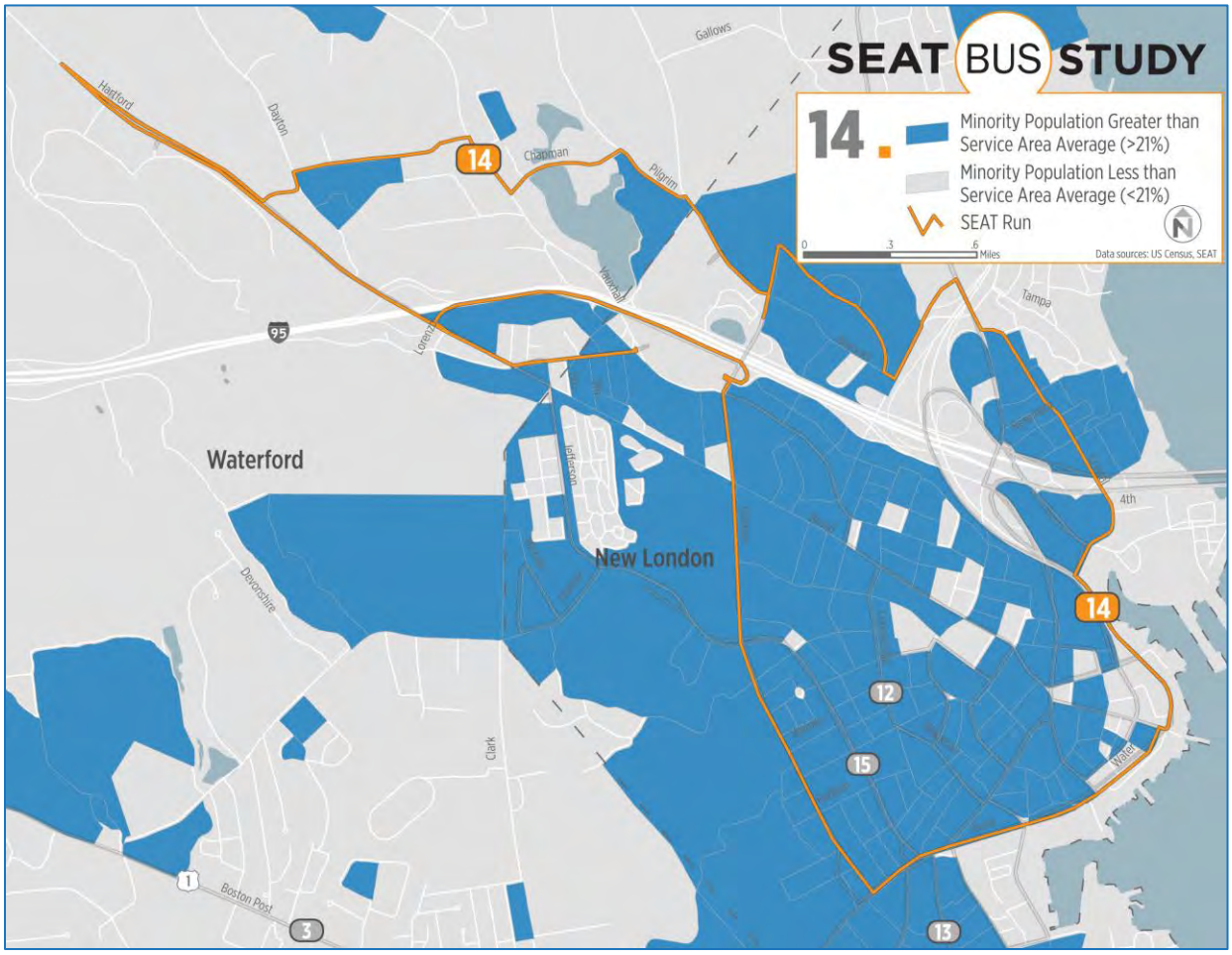
Run 14 predominately serves areas with a higher minority population than is found in the SEAT service area overall. Slightly less than half (43%) of the population served by Run 14 lives in census blocks that have a minority population greater than the overall service area average (21%). These minority populations are concentrated in New London, as shown in Figure 16.

FIGURE 15 – SERVICE TO BLOCKS WITH HIGH MINORITY POPULATIONS



Sources: US Census 2010, SEAT

FIGURE 16 – MAP OF BLOCKS WITH HIGH MINORITY POPULATIONS



Sources: US Census 2010, SEAT

SERVICE IMPROVEMENT OPTIONS

Run 14 is one of the primary runs that provide service in New London and Waterford, and its productivity is fair. However, Run 14 is essentially a one-way loop, which is designed to increase the run's geographic service area of coverage, but it makes the run less useful for riders. The run also duplicates service with other New London runs, particularly Run 12. Finally, the service alignment is somewhat complex and not as straight and direct as it could be. Overall, straightening and simplifying its alignment would go a long way to improve the run's design and provide a more attractive service. Options for improved service include:

- **Separate into two runs and provide bidirectional service.** One of the major issues with Run 14 is that it operates in one large loop, meaning that passengers doing a roundtrip would have to ride the entire loop in some part of their journey. Run 14 could be split into two runs, each providing bidirectional service — perhaps one north of I-95 and one in the neighborhoods south of I-95. Alternatively, Run 14 could focus on areas north of I-95 while Run 12, which operates very close to the southern portion of the run, could provide bidirectional service on the southern portion of the run on Jefferson Avenue and Colman Street. Careful consideration of scheduling and interlining (having a transit vehicle serve multiple runs) is necessary to avoid any major increases in operational costs or additional fleet requirement.

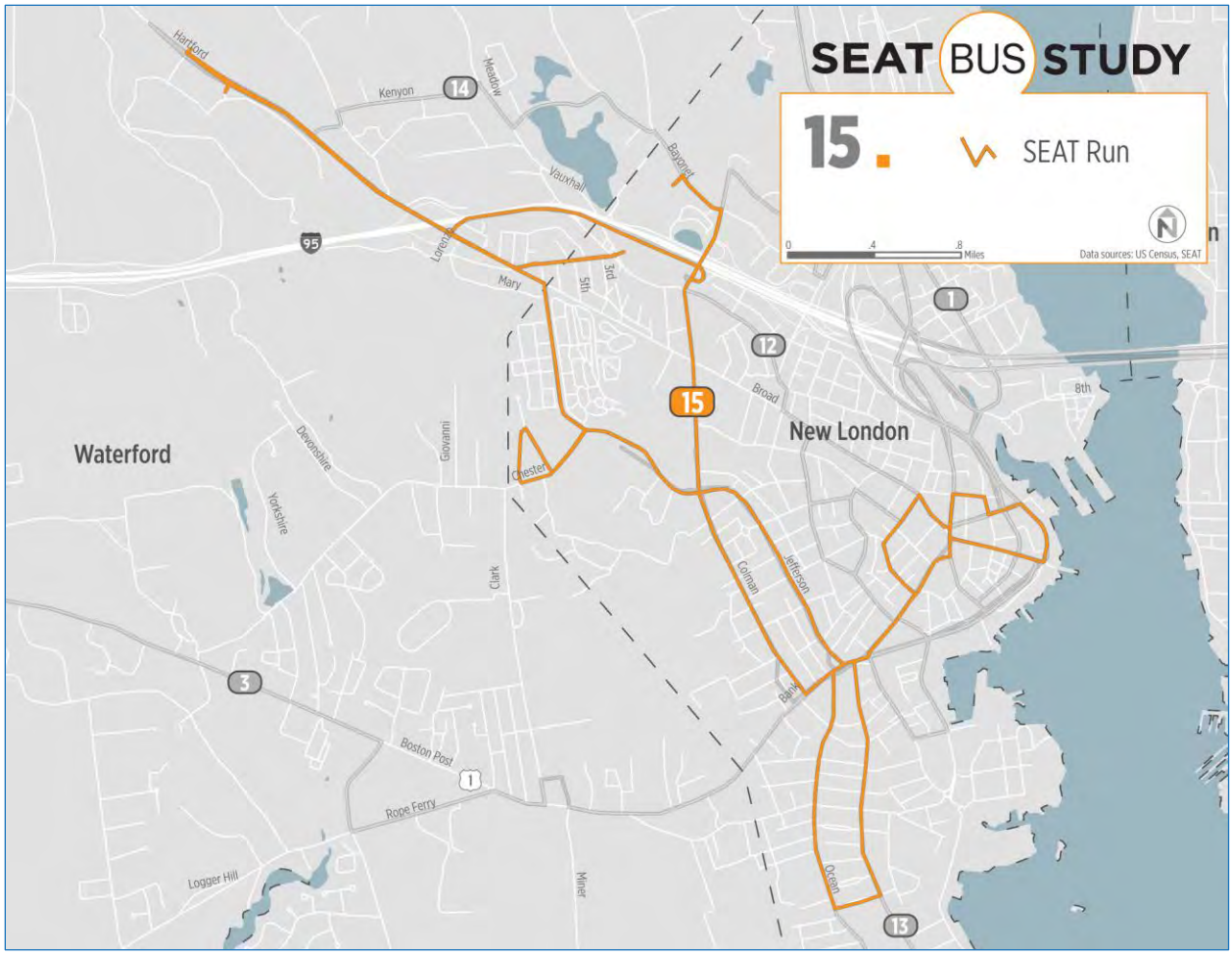
- **Redesign to serve unique market.** Run 14 and Run 12 both serve very similar and overlapping areas, providing service between downtown New London, Crystal Mall, and neighborhoods in between. Run 14 could be redesigned in coordination with Run 12 to give each run a more clearly defined and unique area to serve. Run 14 could be redesigned to focus on its most unique area, which is north of I-95, leaving the areas south of I-95 for Run 12. Or more significantly, a redesign of all of New London's services so they are each more focused and coordinated, would provide an opportunity to greatly improve service throughout New London.
- **Improve circulation through New London Shopping Center.** Currently Run 14 serves the New London Shopping Center with a circuitous alignment that significantly slows through travel times. The alignment could be simplified by staying on Vauxhall Street and not deviating into the shopping center or the frontage road. Shopping center riders could board and alight at either Phillips Street or US-1/Colman Street, depending on which side of the shopping center they are visiting. This simplified alignment would likely cut a few minutes of travel time for those passengers riding through.
- **Straighten out the run.** Run 14 is a large one-way loop and the service it offers is quite indirect. The run could be simplified and straightened out to make it more direct. This service improvement option would likely be implemented in coordination with other service improvement options as part of a run redesign. However, it may be difficult to achieve a more direct path through the areas north of I-95 due to the irregular street network.

SERVICE EVALUATION

RUN 15 (NEW LONDON / WATERFORD)

Service Design. Run 15 is New London's evening overlay service, serving many segments that usually have daytime service with Runs 12, 13, and 14. Like many of the runs serving New London, Run 15 is a coverage-focused run that operates with several deviations and loops. The run begins at New London Union Station, first operates north on Water Street, west on Governor Winthrop for a short segment before deviating to serve Union Street, Federal Street, and returning south Huntington Street, then southwest on Jay Street to Bank Street. The run then deviates to serve a loop on Montauk Street, Fair Harbour Place (near Lawrence Memorial Hospital), and then north again on Ocean Avenue. After this deviation, the run continues north on Jefferson Avenue, deviates on Chester Street to serve Eagle Pointe Apartments, then continues on Jefferson Avenue, Broad Street and the Hartford Turnpike to serve the Crystal Mall and Waterford Commons Shopping Center. In the eastbound direction, the run begins at Waterford Commons, operates via Hartford Turnpike, Broad Street, and Phillips Street to serve the New

FIGURE 1 – RUN MAP



London Mall. From there, the run loops back north via Phillips Street, Broad Street, before heading southbound on South Frontage Road, looping north on Colman Street and Bayonet Street to serve the additional shopping centers on the other side of the highway, and then returning southbound on Colman Street all the way down to Bank Street, where it proceeds eastbound to Truman Street, deviating again to serve Hempstead Street, north on Williams Street, and south on Broad Street, finally returning to New London Union Station via State Street.

Service Schedule. Run 15 operates during evenings only on weekdays and Saturday. Service is every hour from 7:00 PM until 10:25 PM. Like the rest of the local New London bus runs, Run 15 does not operate on Sunday.

FIGURE 2 – SCHEDULE STATISTICS

Service Day	Span of Service	Frequency (min) Peak / Off-Peak	Daily Trips
Weekday	7:00 PM — 10:25 PM	60	8
Saturday	7:00 PM — 10:25 PM	60	8
Sunday	-	-	-

Source: SEAT Run Schedules

Interaction with System. Because Run 15 only operates during the evening when many other runs have stopped operating, it offers limited transfer opportunities. The following runs operate in the evening, and thus allow for transfers to Run 15:

- **Run 1/101** at New London Union Station for service to Norwich. Run 1/101 operates every two hours until 11:00 PM on both weekdays and Saturdays.
- **Run 108** at New London Union Station for service to Foxwoods Casino. Run 108 operates until 10:00 PM on weekdays and 9:05 PM on Saturday.

Run 15 is designed to provide evening service for segments served by New London daytime runs. The following sections are the equivalent daytime segments:

- **Montauk and Ocean Avenues**: Run 13 provides normal daytime service, although daytime service extends to Ocean Beach.
- **Jefferson Avenue and the Eagle Pointe Apartments (Chester Street) deviation**: Run 12 provides daytime service.
- **Colman Street**: Run 14 provides daytime service.
- **Hartford Turnpike**: Run 12 provides service to the Waterford Commons on the Hartford Turnpike. Additionally Runs 12 and 14 provide service to Crystal Mall on Hartford Turnpike.
- **New London Mall**: Run 14 normally serves daytime service on Bayonet Street, however approaches the mall from Crystal Avenue as opposed to a deviation via Colman Street.
- **Circulation within central New London**: Run 13 provides significant coverage during the day in central New London, deviating north and south of Bank Street.

Ridership by Service Day. Run 15 carries few riders, with one of the lowest ridership levels of all SEAT runs (see Figure 4). However, the run's low ridership is because Run 15 only operates during the evening period; ridership per trip (Figure 5) and per hour (Figure 13) are better comparison measures for this run. On weekdays, Run 15 carries 41 passengers, which is an average of 5.1 per trip and far below the systemwide average of 13.0 riders per trip. On Saturdays, the run carries 37 passengers, which averages to 4.6 passengers per trip, also well below the systemwide average of 9.5 riders per trip.

FIGURE 3 – RIDERSHIP STATISTICS

Service Day	Daily Ridership	Ridership per Trip	
	Run 15	Run 15	System Avg
Weekday	41	5.1	13.0
Saturday	37	4.6	9.5
Sunday	-	-	5.8

Source: SEAT Ridecheck 2014

FIGURE 4 – AVERAGE WEEKDAY RIDERSHIP

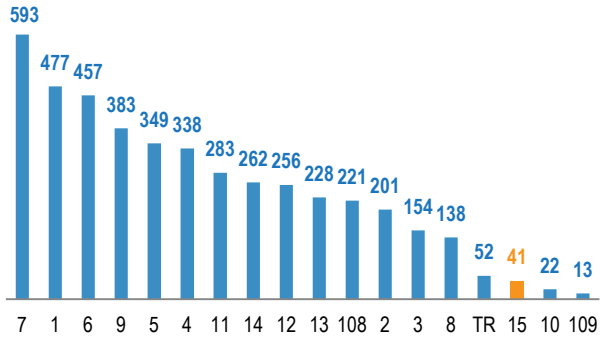
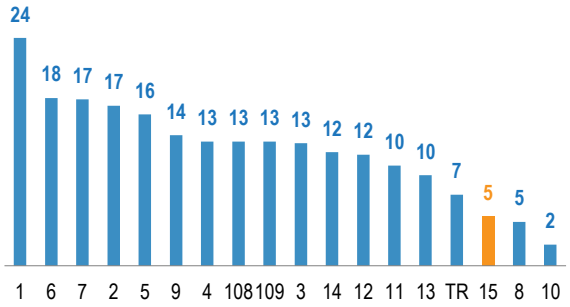


FIGURE 5 – AVERAGE WEEKDAY RIDERSHIP PER TRIP



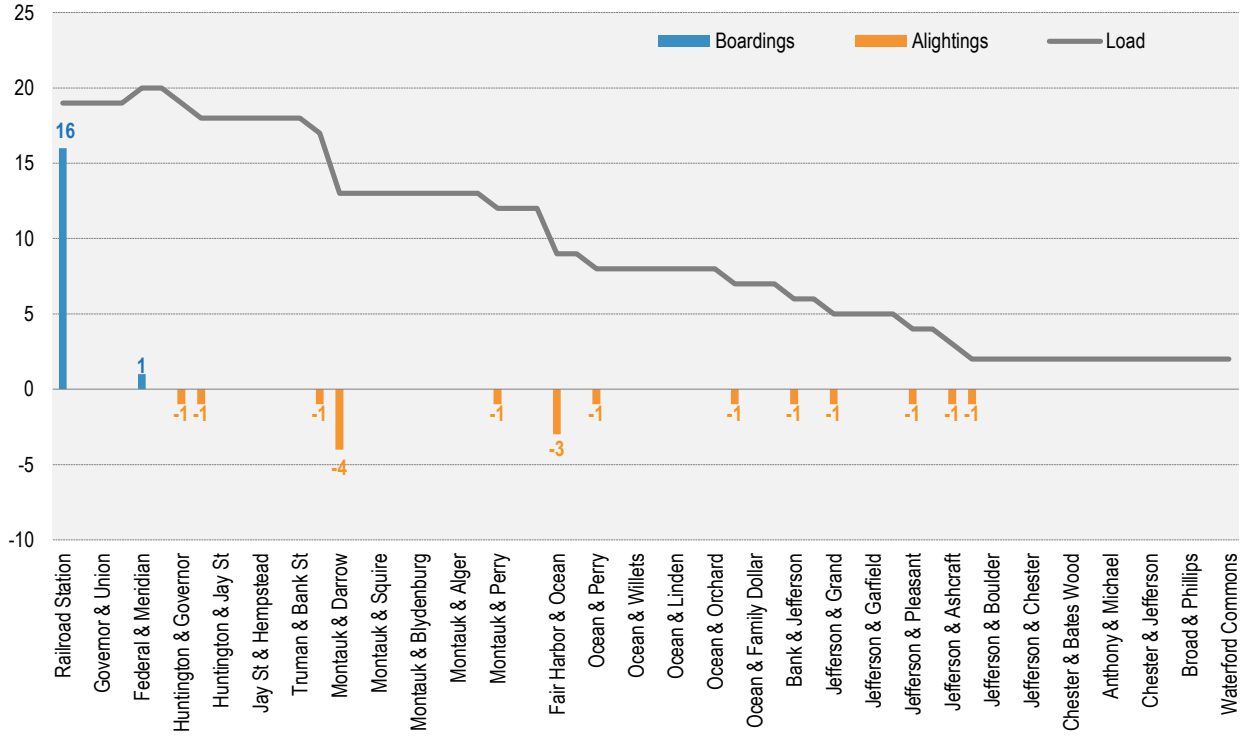
Source: SEAT Ridecheck 2014

Ridership by Stop. Similar to the daytime Runs 14 and 12, ridership is concentrated at New London Union Station and the various malls and shopping centers that the run serves. In addition, some apartment complexes have comparatively higher activity. Though ridership on the run is generally low, the following areas generate the most ridership:

- **New London Union Station** has 16 daily boardings and 7 daily alightings. The run's strong orientation to this stop is another indication of the regional importance of the New London Union Station, which offers connections to other runs in the SEAT system (though only two at night) and also train service throughout New England.
- **Crystal Mall** has 14 daily boardings and 2 daily alightings. This is another regionally important destination, though ridership activity at night is less than during the daytime.
- **Broad Street at Lorenzo Street** (residential neighborhood) has a total of 5 daily boardings.
- **Colman Street at Redden Avenue** is close to several clusters of affordable housing units. There are 5 daily alightings at this stop.

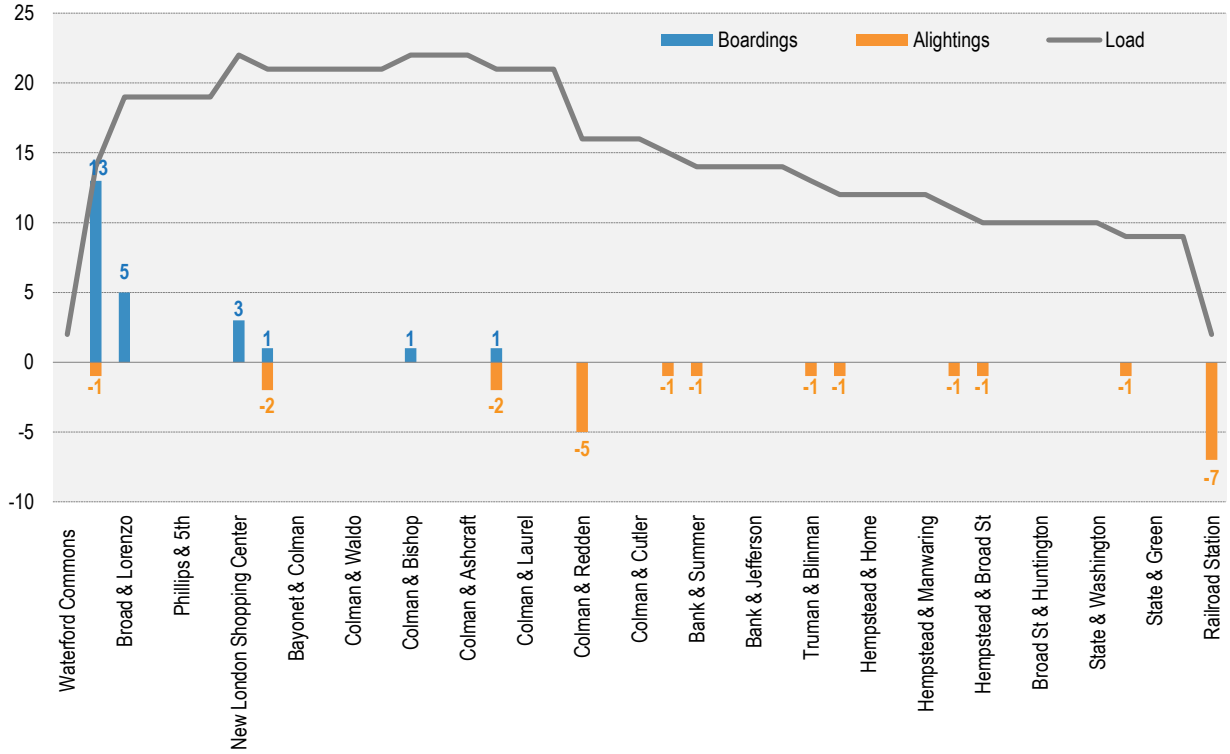
Outside of the New London Union Station, Run 15's ridership is primarily at the various shopping centers on the line. This indicates that many passengers are most likely using other runs to access the malls during daytime service and then returning home at night using Run 15. Despite the Crystal Mall having a relatively high number of boardings, other malls on the run do not have nearly as high ridership.

FIGURE 6 – WESTBOUND WEEKDAY RIDERSHIP BY STOP CHART



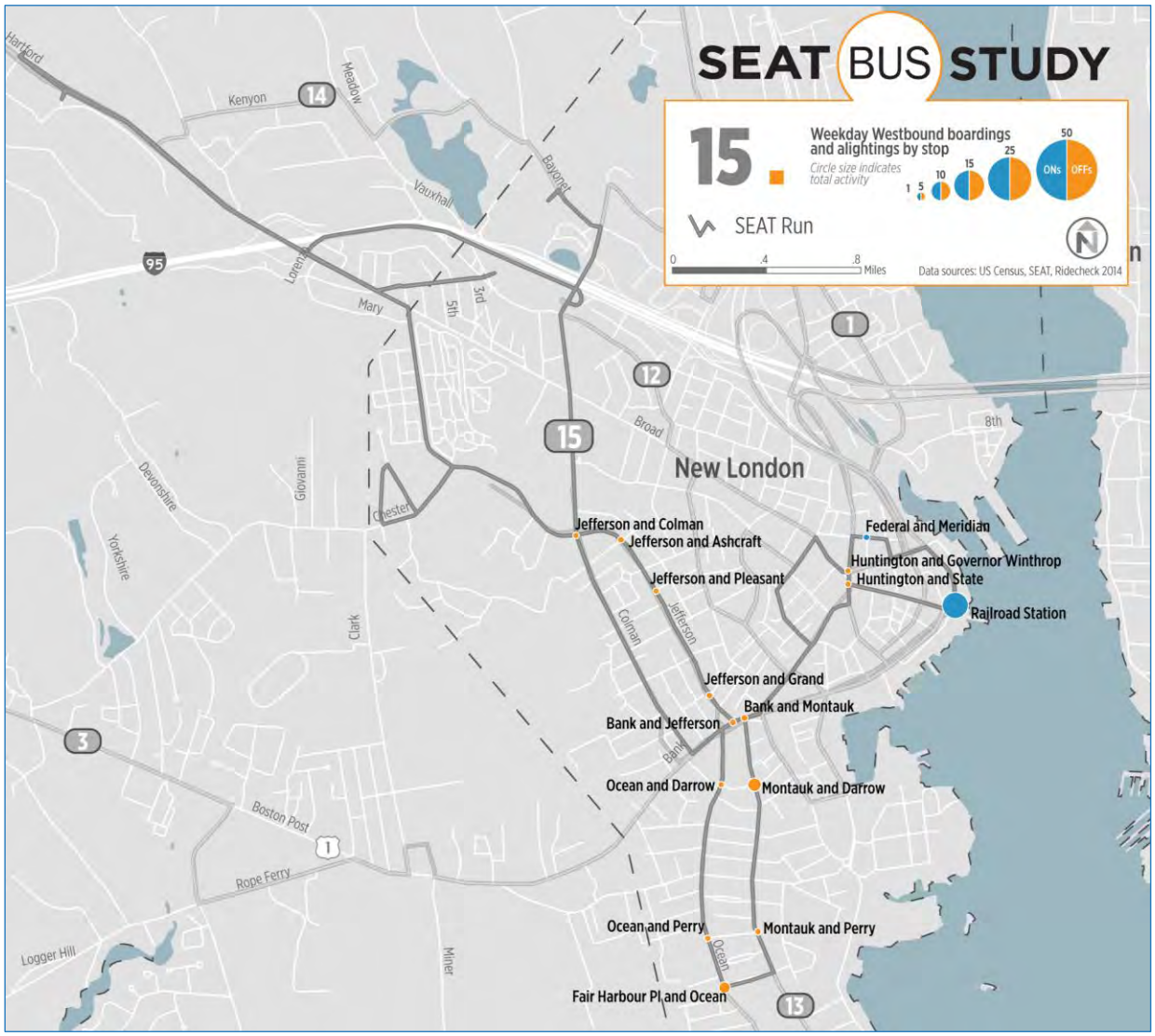
Source: SEAT Ridecheck 2014

FIGURE 7 – EASTBOUND WEEKDAY RIDERSHIP BY STOP CHART



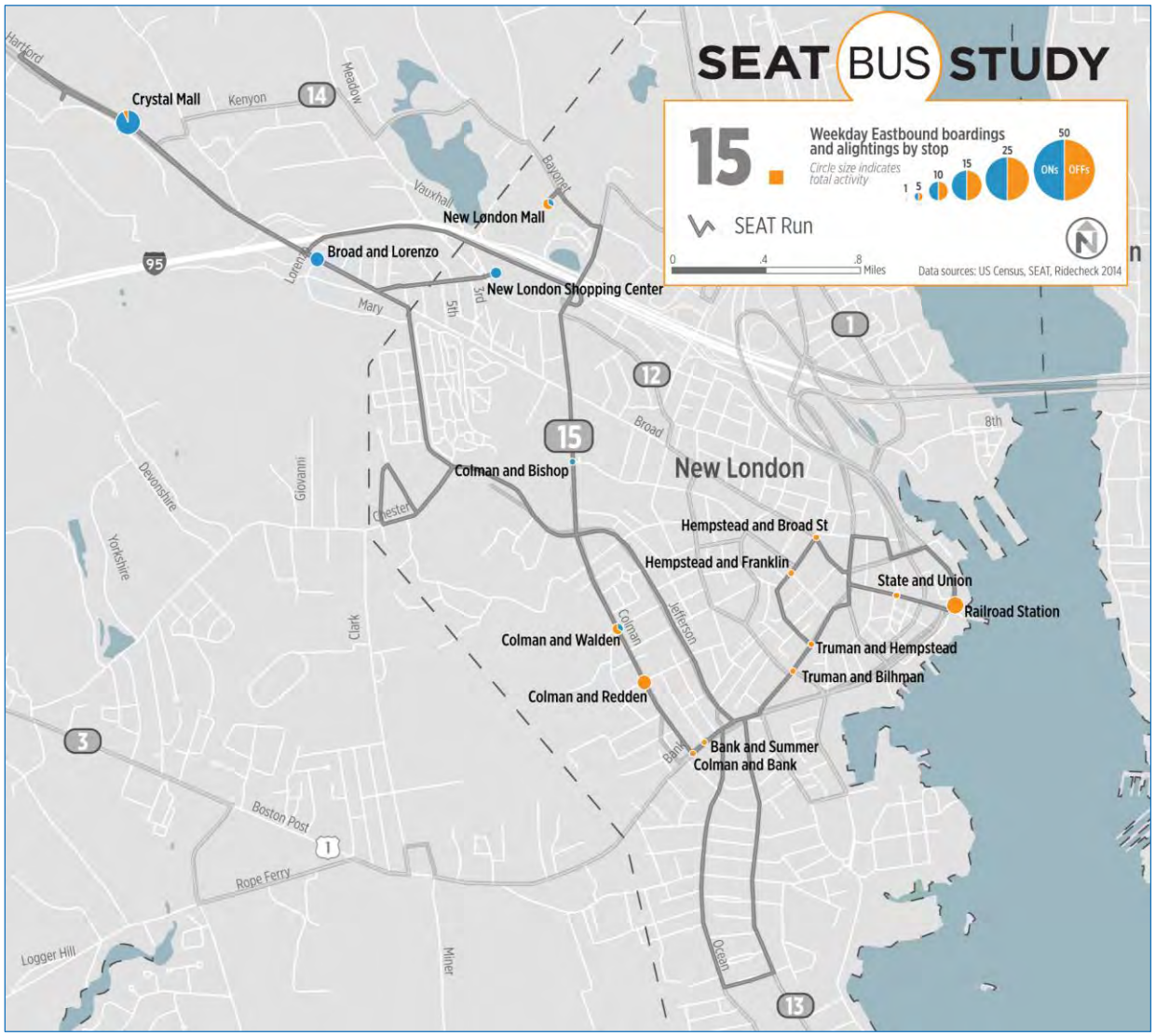
Source: SEAT Ridecheck 2014

FIGURE 8 – WESTBOUND WEEKDAY RIDERSHIP BY STOP MAP



Source: SEAT Ridecheck 2014

FIGURE 9 – EASTBOUND WEEKDAY RIDERSHIP BY STOP MAP



Source: SEAT Ridecheck 2014

Ridership by Trip. Ridership is primarily focused in the eastbound direction for most of the evening, except for the last trip. This is most likely due to the fact that passengers are returning home from the run's shopping centers in the evening. The final westbound trip at 10:00 PM has the highest ridership of all westbound trips, however its return trip eastbound has only one rider. This peak in westbound riders could potentially be due to the transfer opportunities at New London Union Station from the last eastbound Run 108 trip from Foxwoods Casino.

FIGURE 10 – WESTBOUND WEEKDAY RIDERS PER TRIP

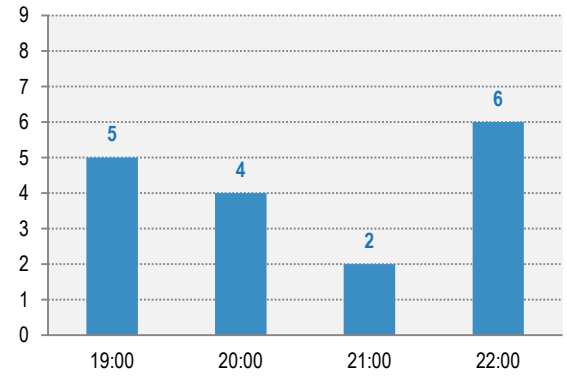
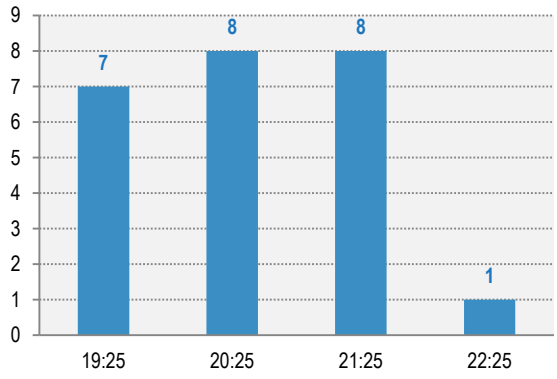


FIGURE 11 – EASTBOUND WEEKDAY RIDERS PER TRIP



Source: SEAT Ridecheck 2014

Performance. Overall, Run 15 performs far below the systemwide average due to its limited ridership and limited service market of evening riders. The run carries an average of just 10.3 riders per revenue hour, half the weekday average, and 9.3 riders per trip on Saturdays, just over half the Saturday average (see Figures 12 and 13). The run's average speed is close to the systemwide average, though night services usually operate faster due to less traffic congestion.

On-time performance is slightly above the rest of the network at 66.7%, however on Saturdays, only 25% of all trips arrive on time. Reliability is therefore a major issue on the run. The number of turns and deviations are a likely contributing factor for its poor on-time performance (as well as its average speed), and thus simplifying the alignment could be a way to reduce run time and improve performance. Saturday's poor on-time performance may be due to traffic congestion, irregular driver behavior, or an unusually late trip on the sampled day.

FIGURE 12 – PERFORMANCE MEASURES

Performance Measure	Weekday		Saturday		Sunday	
	Run 15	System Avg	Run 15	System Avg	Run 15	System Avg
Passengers per Revenue Vehicle Hour	10.3	20.9	9.3	16.4	-	12.9
Passengers per Revenue Vehicle Mile	0.7	1.6	0.7	1.2	-	0.8
Average Speed (mph)	14.2	16.2	14.2	15.2	-	17.6
On-Time Performance Reliability*	66.7%	57.9%	25.0%	52.8%	-	40.8%

*On-Time Performance is the percent of sampled observations where the bus arrived at timepoints within 5 minutes of the scheduled time.
Source: SEAT Analysis Factors 2014

FIGURE 13 – WEEKDAY RIDERS PER REVENUE HOUR

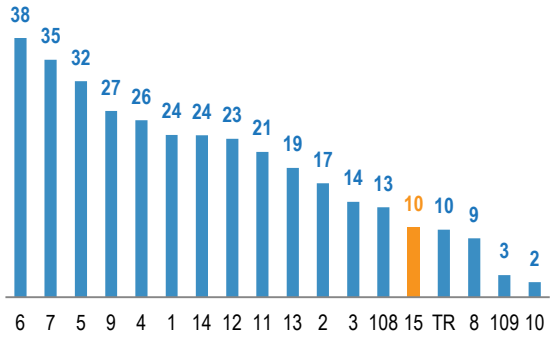
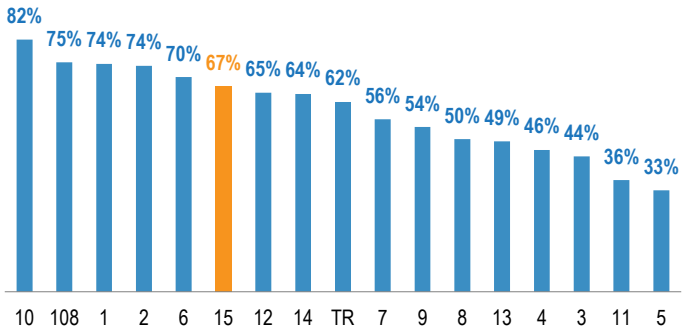


FIGURE 14 – WEEKDAY ON-TIME PERFORMANCE

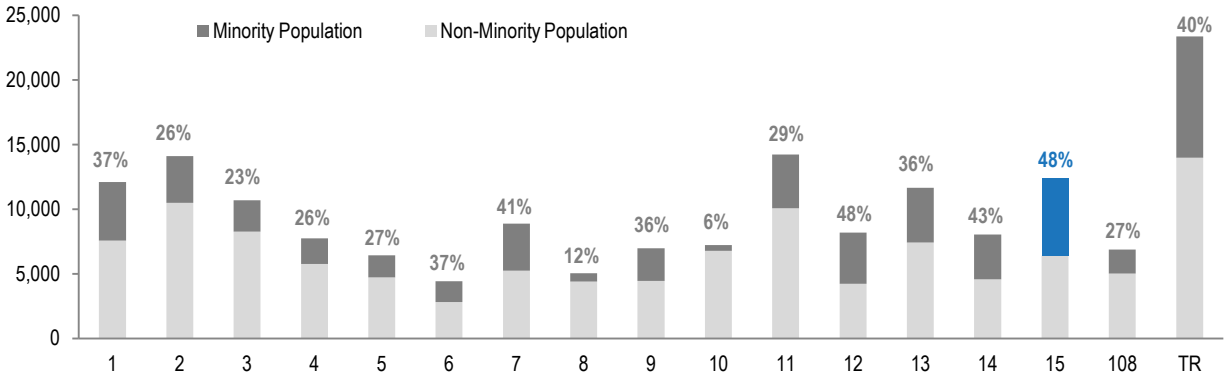


Source: SEAT Ridecheck 2014

Environmental Justice

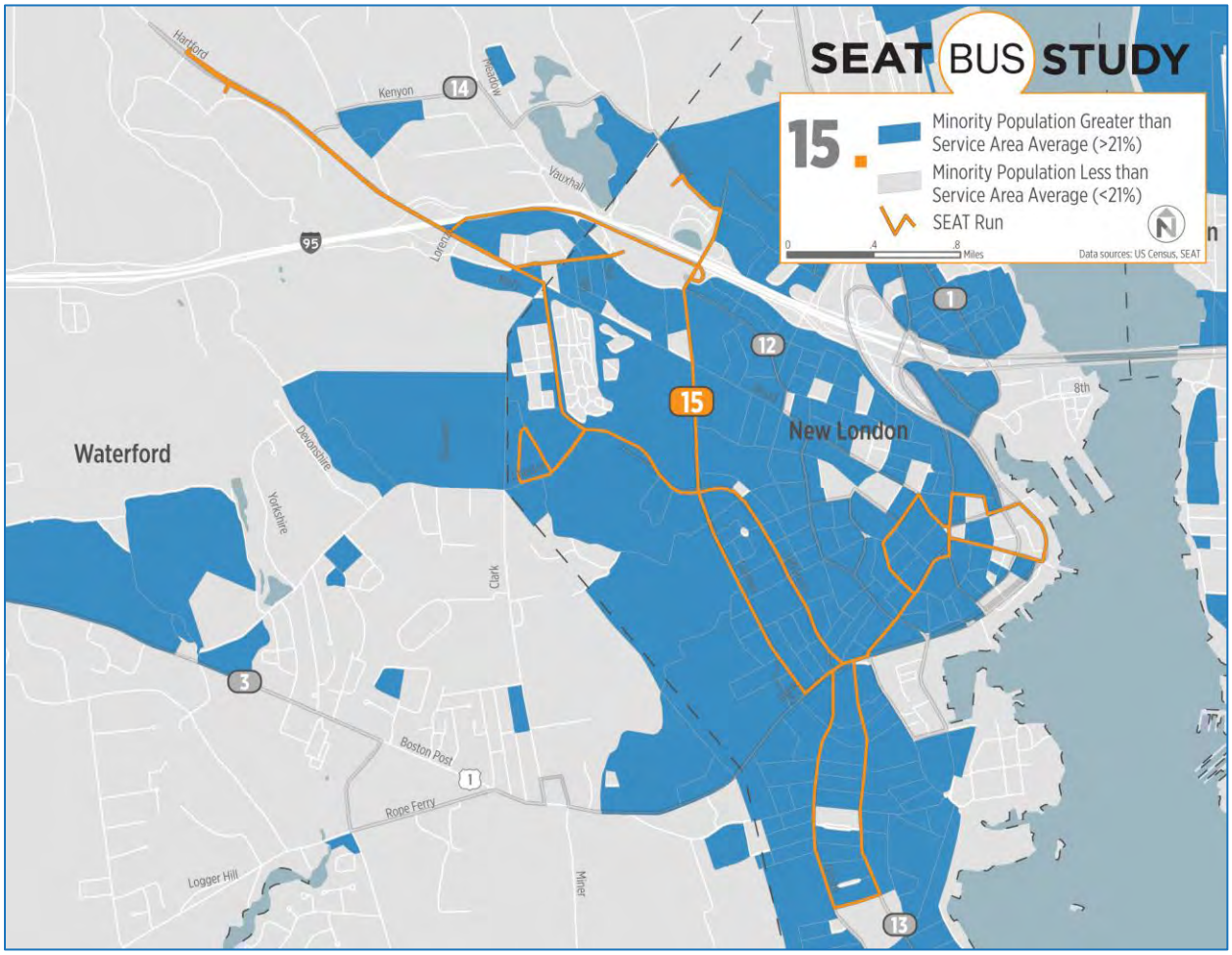
Run 15 predominately serves areas with a much higher minority population than is found in the SEAT service area overall. Nearly half (48%) of the population served by Run 15 lives in census blocks that have a minority population greater than the overall service area average (21%). As shown in Figure 16, these minority populations are concentrated in New London.

FIGURE 15 – SERVICE TO BLOCKS WITH HIGH MINORITY POPULATIONS



Sources: US Census 2010, SEAT

FIGURE 16 – MAP OF BLOCKS WITH HIGH MINORITY POPULATIONS



Sources: US Census 2010, SEAT

SERVICE IMPROVEMENT OPTIONS

Run 15 is an evening-only overlay service that aims to provide service throughout New London and into Waterford to serve retail areas. Accordingly, the run's alignment is circuitous and indirect, which slows down service and impacts on-time performance. Consequently, Run 15's productivity and performance rank fairly low. The run, however, provides a vital service offering the only public transit option after 6:00 PM. Options to improve the service include:

- **Eliminate Chester Street deviation.** Currently no riders board or disembark at stops on the Chester Street deviation. Eliminating this diversion loop would improve trip times for all passengers. In addition, Jefferson Avenue is a short walk to the Eagle Pointe apartments where the bus currently operates, and thus elimination would only be a minor inconvenience for the occasional rider that would have to make the short walk.
- **Eliminate Bayonet Street deviation.** Despite the presence of part of the New London shopping center on the north side of I-95, currently only two riders board at this side of the mall. Eliminating the deviation up to Bayonet Street would speed up service for the majority of riders.
- **Truncate service at Crystal Mall.** Waterford Commons has a cluster of stores, however, no ridership is present on Run 15. Truncating the run at Crystal Mall would allow for the savings in service time to be reapplied somewhere else.

- **Discontinue Run 15.** Run 15 is one of the lowest ridership runs in the SEAT system, carrying fewer than 50 riders per day and only 5 riders per trip. Because there are very limited evening services for Run 15 to connect to, the run's market is largely limited to local evening circulation within New London, and that market may not be sufficient to justify service. The run could be discontinued to focus resources on the more productive services in the system (including improving daytime service in New London).
- **Operate via Colman Street between Jefferson and New London Mall in both directions.** Currently, the Jefferson Avenue alignment between Colman Street and Broad Street carries no passengers. Using Colman Street to access the New London Mall would allow for bidirectional service coverage in a populated area instead of running service between two cemeteries. This would also shorten the alignment and run time (see the blue run option on Figure 17).
- **Separate Run 15 into two services.** The Ocean/Montauk Avenue section of the run serves a separate and distinct market, with most activity coming from the New London Union Station. Serving this part of the run, however, requires a significant deviation. Making this deviation into a separate run would allow for more direct service for all passengers (see two potential runs in Figures 17 and 18). The aggregated time savings from the above service improvement options would likely be sufficient to operate these two lines (interlined between the two).

FIGURE 17 – POTENTIAL SERVICE REDESIGN RUN

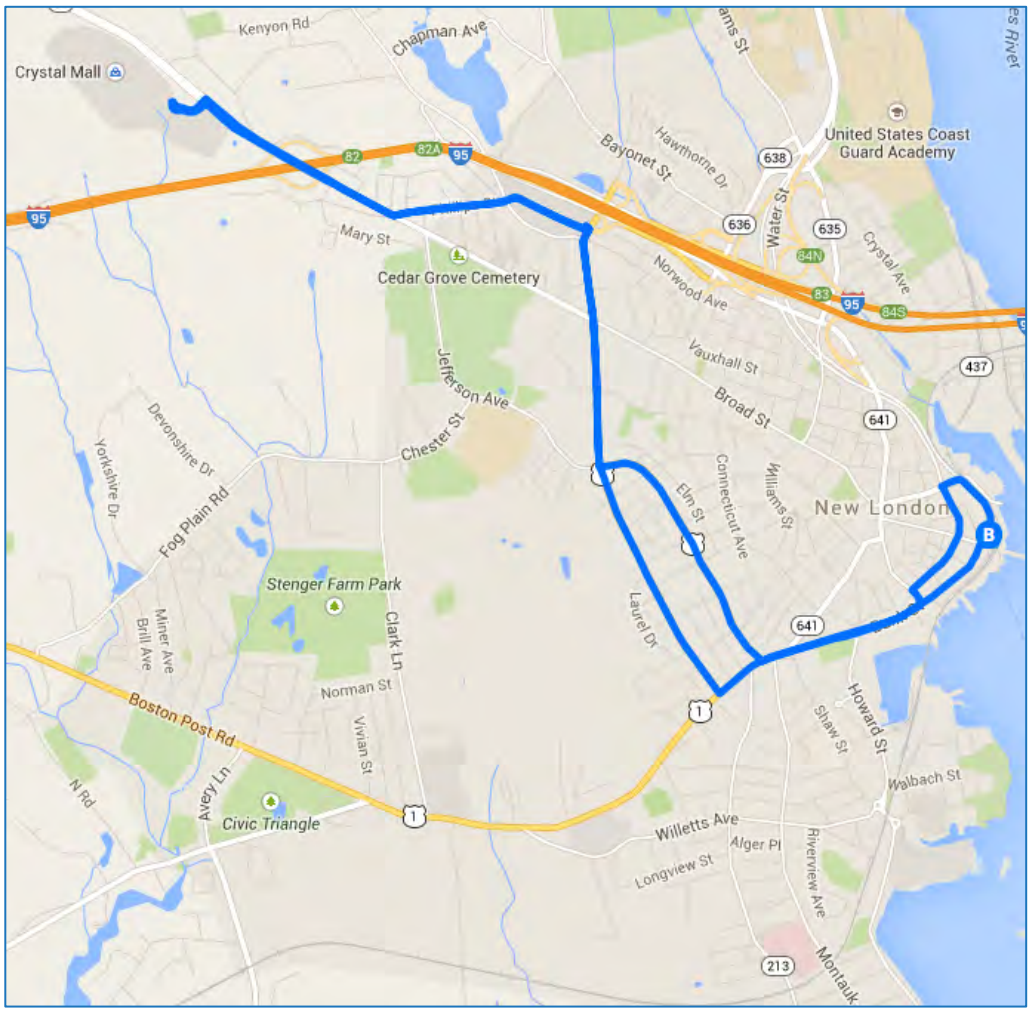
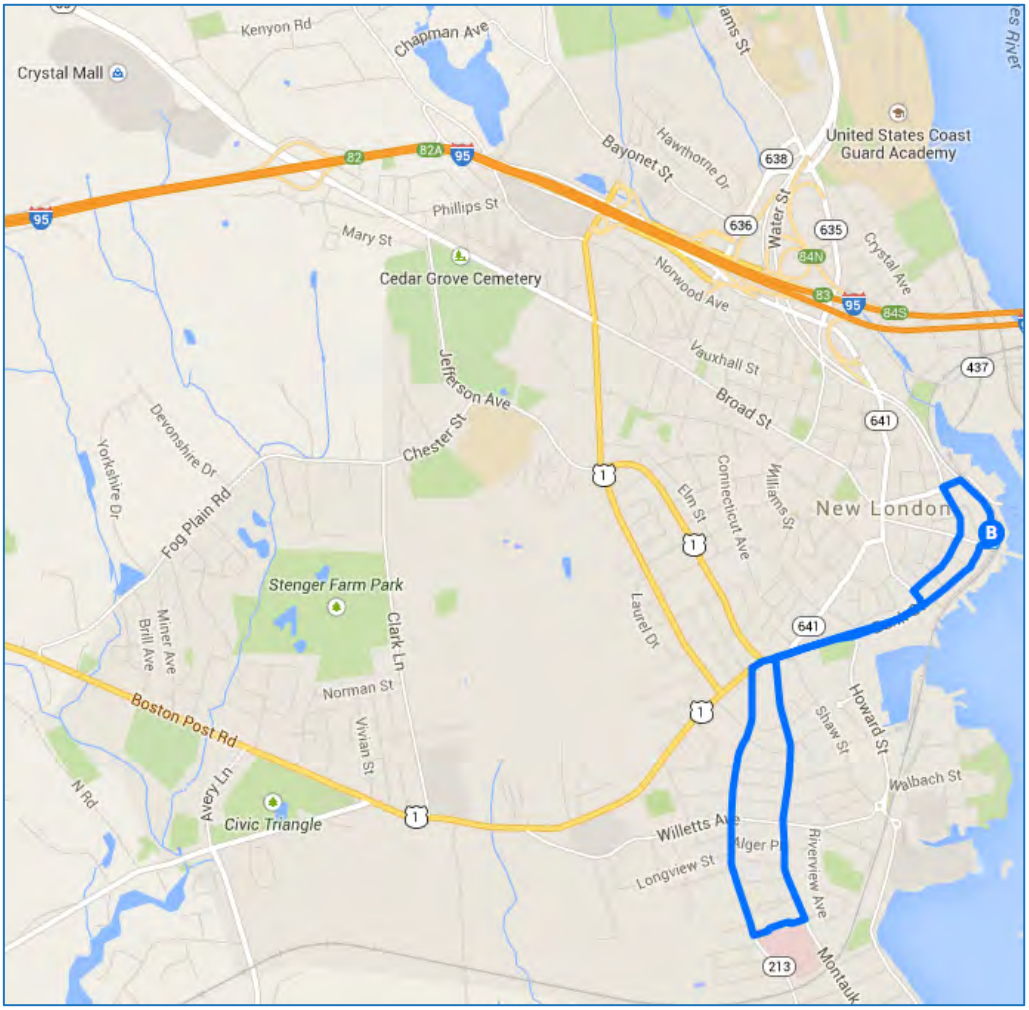


FIGURE 18 – POTENTIAL SERVICE REDESIGN RUN



SERVICE EVALUATION

RUN 108 (NEW LONDON / GROTON / OLDE MISTICK VILLAGE / FOXWOODS)

Service Design. Run 108 operates between the New London Union Station and Foxwoods Casino via Groton and Olde Mistick Village Shopping Center in Mystic. Service operates primarily on I-95 between New London and North Stonington, and then on Norwich Westerly Road (Route 2) to access the casino. Two deviations occur on the run: Plaza Court and Pequot Medical Center in Groton (via Long Hill Road, Fort Hill Road, and Newtown Road), and Olde Mistick Village Shopping Center, just off of I-95 in Mystic. The service alignment is mostly consistent in both directions.

Service Schedule. Run 108 operates seven days a week and operates every two hours. On weekdays, service operates from 6:00 AM to 10:00 PM, on Saturdays from 6:00 AM to 9:05 PM, and on Sundays from 6:00 AM to 1:05 PM. There is an additional weekday trip between New London Union station and Foxwoods (no return) at 10:00 PM that skips Olde Mistick Village.

FIGURE 1 – RUN MAP

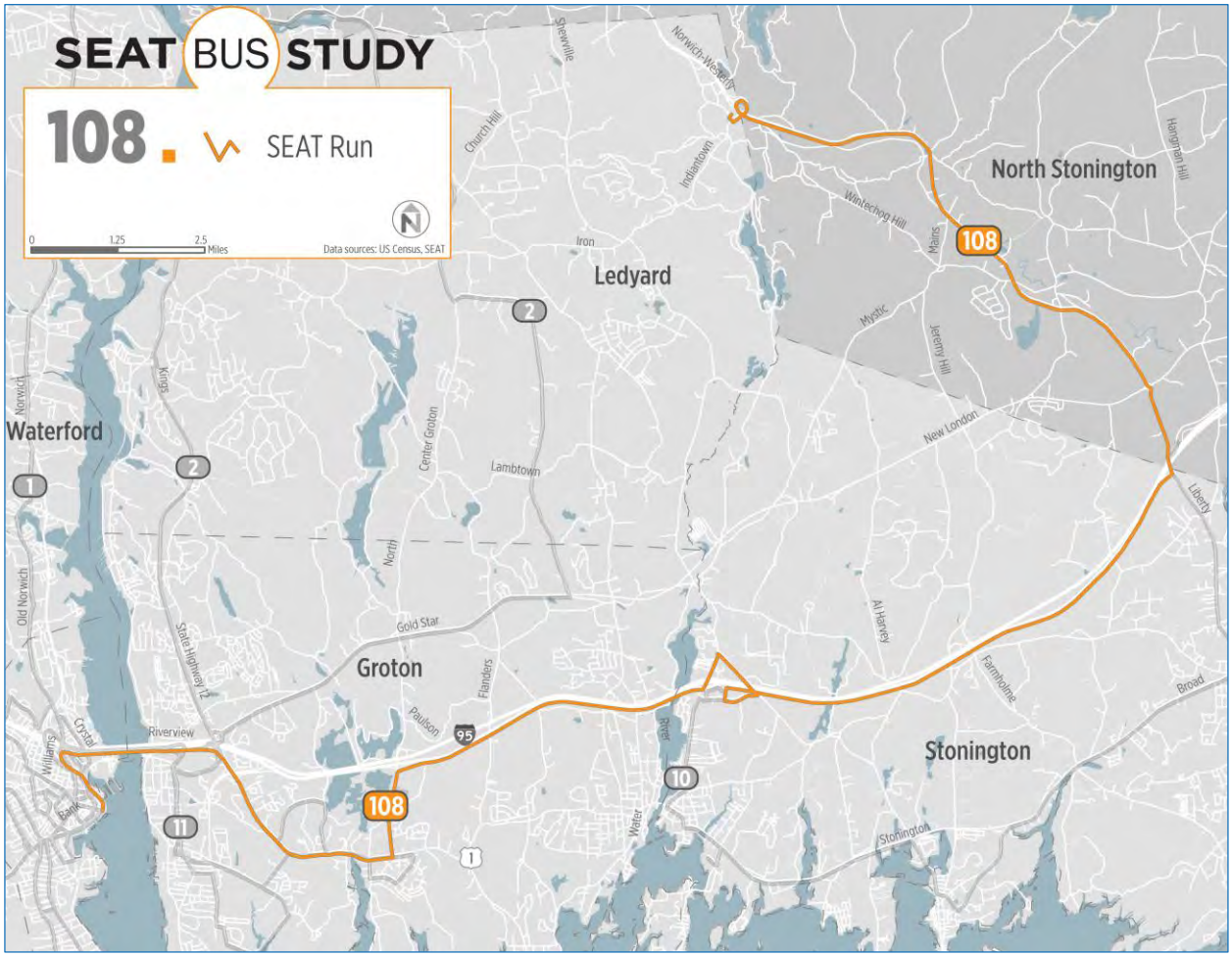


FIGURE 2 – SCHEDULE STATISTICS

Service Day	Span of Service	Frequency (min) Peak / Off-Peak	Daily Trips
Weekday	6:00 AM — 10:00 PM	120	17
Saturday	6:00 AM — 9:05 PM	120	16
Sunday	6:00 AM — 1:05 PM	120	8

Source: SEAT Run Schedules

Interaction with System. Run 108 provides numerous transfer opportunities at New London Union Station. In addition to this transfer point, Run 108 provides an essential link between New London and Groton. Transfers outside of New London can be made at the following locations:

- At Plaza Court in Groton, timed connections between New London-bound Run 108 and southbound Run 11 are available. Transfers in the opposite direction are not timed and may be inconvenient.
- On Long Hill Road, Fort Hill Road, and Newtown Road, Run 108 replaces every other trip of Run 11 on service to Pequot Medical Center.
- At Olde Mistick Village and I-95 Commuter Lot, theoretically one could transfer to Run 10 for service to Mystic and Stonington via Stonington Road (Route 1). The transfer times, however, are not coordinated and could result in wait times in excess of an hour. Therefore, it is unlikely that many riders are making such connections.

Foxwoods also has frequent intercity bus service to other northeastern states. There is daily twice a day service between New London and Foxwoods operated by Greyhound (originating from New York). The fare for this service is high, however, as it caters mostly to visitors and longer distance travelers.

Ridership by Service Day. Run 108 carries 221 passengers per day on weekdays, 208 on Saturday, and 88 on Sunday. Ridership per trip is equal to the SEAT average during weekdays, with an average of 13.0 riders per trip. Due to Foxwoods being a major employment and leisure location on weekends, however, Run 108 performs above average on weekends. Consequently, total ridership on Saturday is almost that of weekdays. On Saturday, ridership per trip is above average at 13.0 compared to 9.5 in the system as a whole. On Sunday, there are 11.0 riders per trip, which is well above the average of 5.8 riders.

FIGURE 3 – RIDERSHIP STATISTICS

Service Day	Daily Ridership	Ridership per Trip	
	Run 108	**Run 108**	**System Avg**
Weekday	221	13.0	13.0
Saturday	208	13.0	9.5
Sunday	88	11.0	5.8

Source: SEAT Ridecheck 2014

FIGURE 4 – AVERAGE WEEKDAY RIDERSHIP

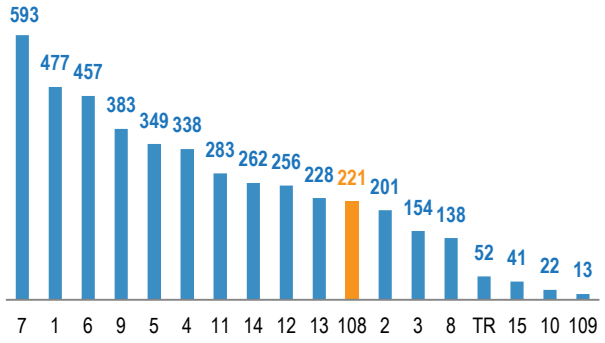
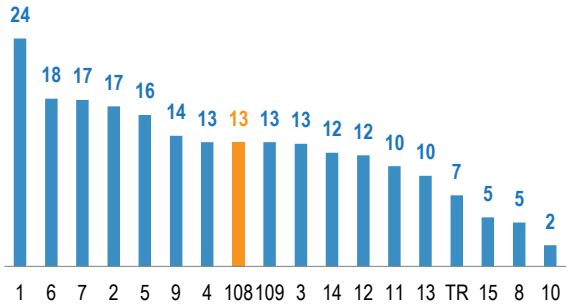


FIGURE 5 – AVERAGE WEEKDAY RIDERSHIP PER TRIP

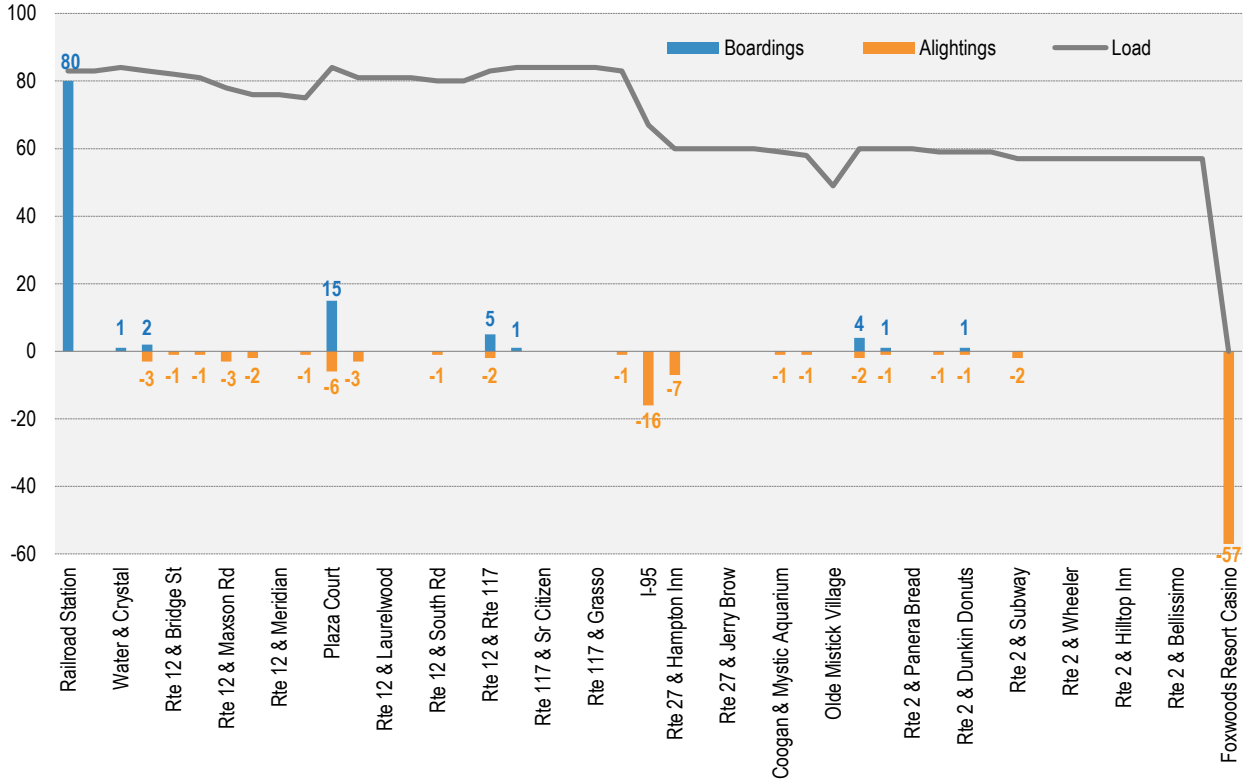


Source: SEAT Ridecheck 2014

Ridership by Stop. Run 108 ridership activity is high at the endpoints, as most riders travel between New London and Foxwoods, primarily eastbound in the morning and returning westbound in the evening. Ridership along the middle segments of the run is much lower. Specifically, New London Union Station has 80 boardings and 54 alightings each day. Foxwoods has 57 boardings and alightings per day. Outside of the endpoints, the following areas have significant ridership activity:

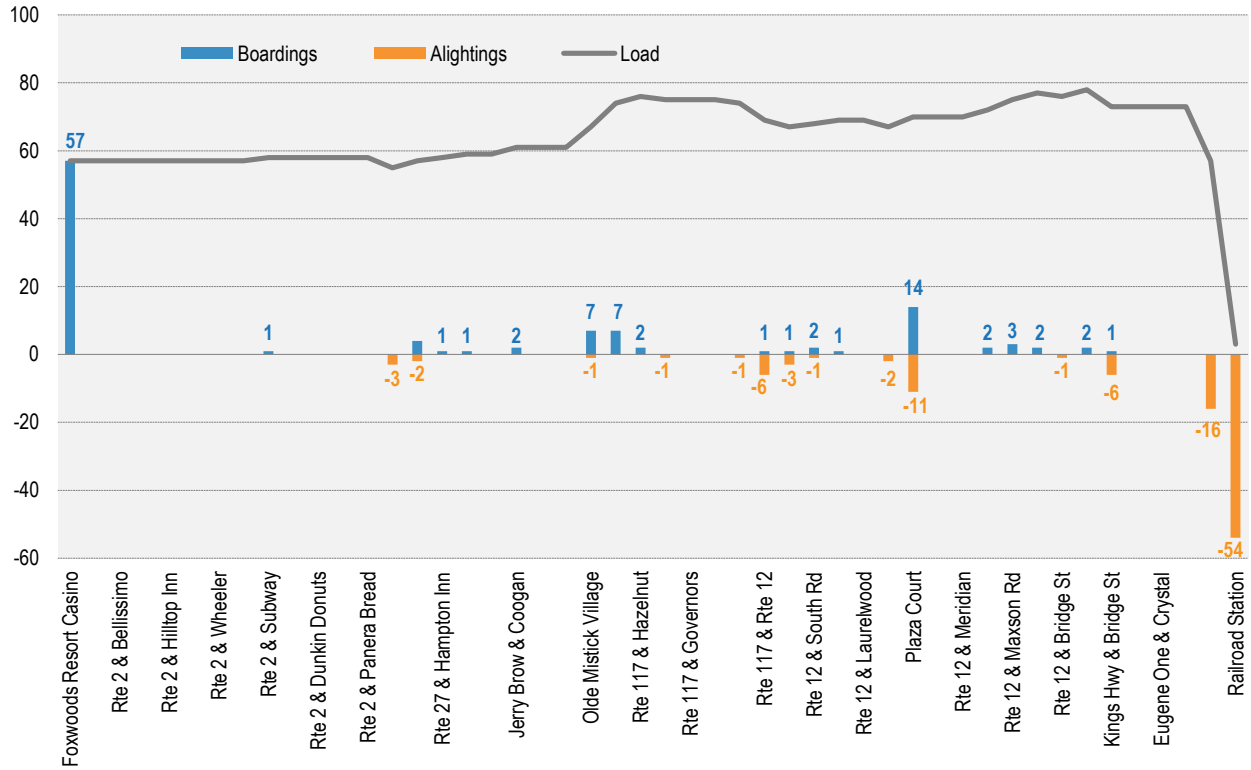
- **Plaza Court.** Run 108 is a primary connection between Groton and New London. Plaza Court offers onward connections to Run 11 Groton. There are 15 boardings and 6 alightings in the eastbound direction, and 14 boardings and 11 alightings in the westbound direction.
- **I-95 exit at Route 117** has 16 eastbound alightings per day, and 7 westbound boardings per day. This area serves the Mystic Marriott Hotel and the Pequot Medical Center.
- **Olde Mistick Village** has activity at multiple clustered locations such as the hotels and the Mystic Aquarium. Activity in this area is likely employees of the various hotels and other businesses in this cluster.
- **US-1/Route 12 (Long Hill Road) has small amounts of dispersed activity.** This corridor is lined with a number of retail and hotel destinations.
- **Other areas have low ridership activity.** Long portions of Run 108 serve corridors with little or no activity, such as I-95 and Route 2.

FIGURE 6 – EASTBOUND WEEKDAY RIDERSHIP BY STOP CHART



Source: SEAT Ridecheck 2014

FIGURE 7 – WESTBOUND WEEKDAY RIDERSHIP BY STOP CHART



Source: SEAT Ridecheck 2014

FIGURE 8 – EASTBOUND WEEKDAY RIDERSHIP BY STOP MAP

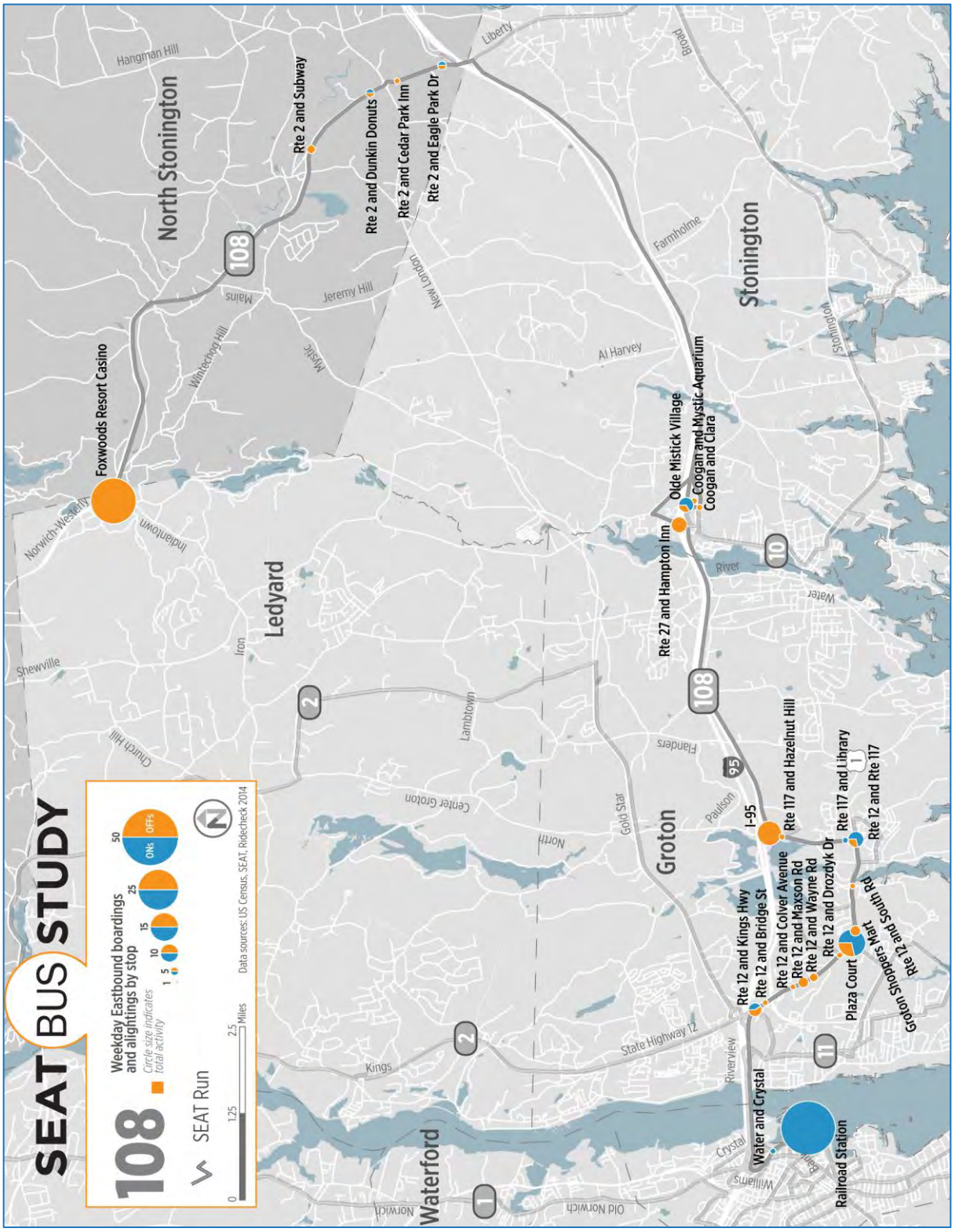
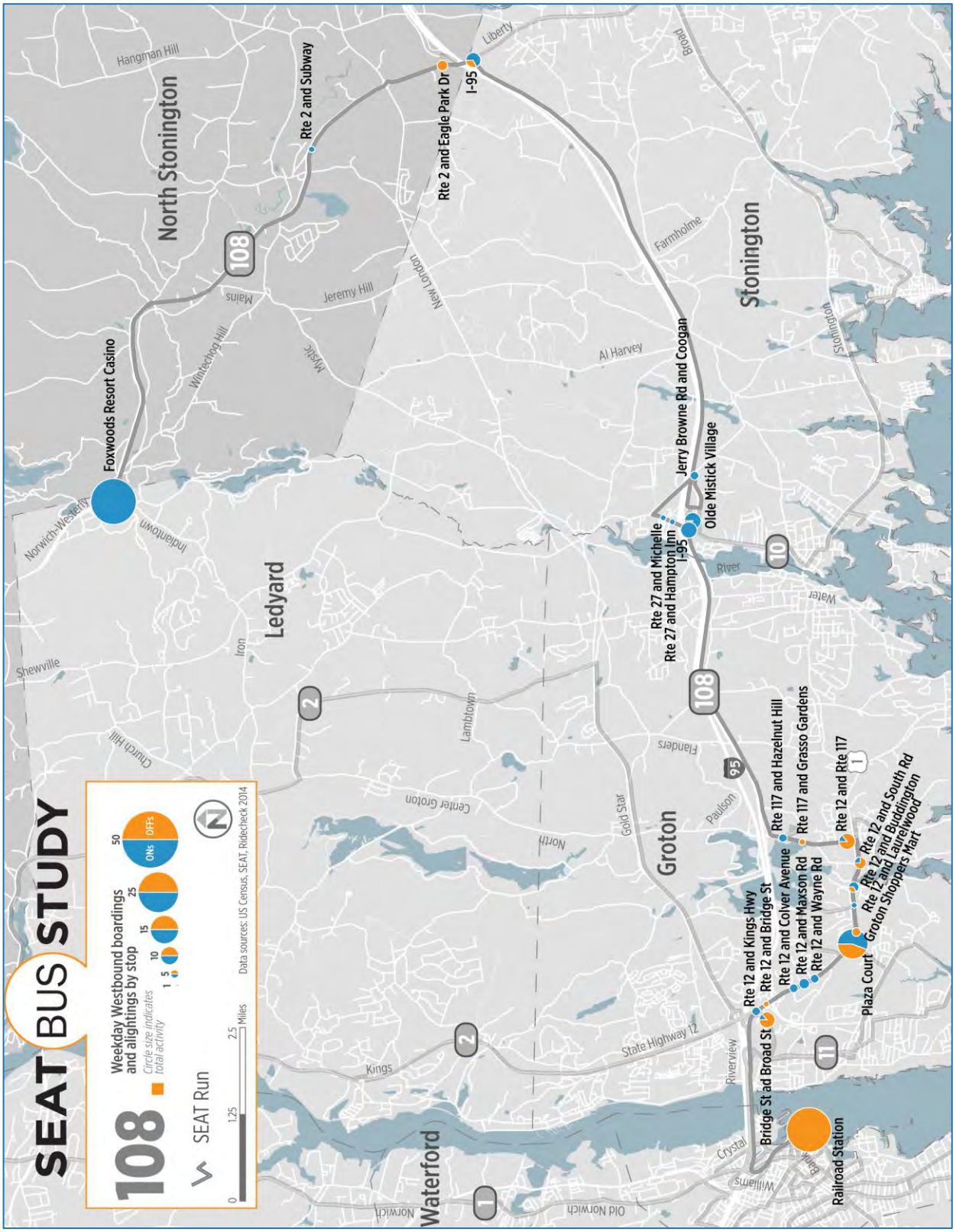


FIGURE 9 – WESTBOUND WEEKDAY RIDERSHIP BY STOP MAP



Ridership by Trip. Ridership patterns suggest that this run caters to employees of Foxwoods Casino, the hotels around Olde Mistick Village, and Plaza Court. In the eastbound direction, ridership is highest in the morning peak with the 8:00 AM trip reaching 33 passengers (see Figure 10). Supplementary Automated Passenger Counter data indicates ridership on this trip is often even higher.

In the eastbound direction, ridership gradually decreases throughout the day until the late evening, when activity increases again on the last two trips of the day, at 8:00 PM and 10:00 PM (see Figure 11). In the westbound direction, ridership gradually increases throughout the day until 5:05 PM, when 24 passengers board to return towards New London. There is a second peak of riders on the final trip of the day, at 9:05 PM.

The run's high eastbound ridership in the AM and high westbound ridership in the PM suggest this run is largely serving a commute market for employees working on the outer ends of the run, such as the Olde Mistick Village vicinity and Foxwoods Casino.

FIGURE 10 – EASTBOUND WEEKDAY RIDERS PER TRIP

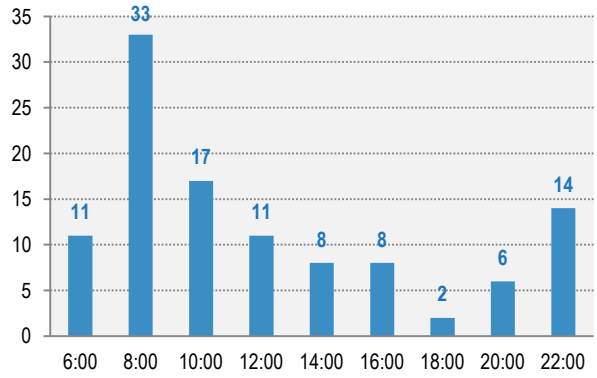
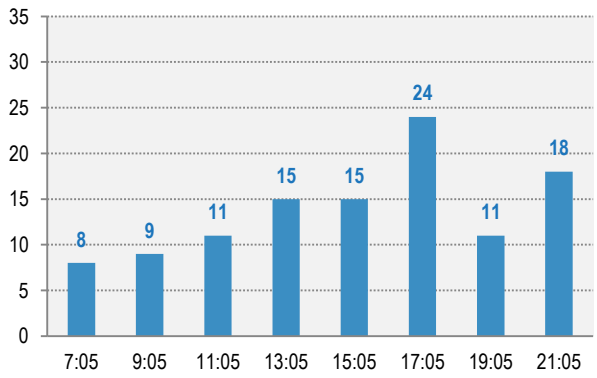


FIGURE 11 – WESTBOUND WEEKDAY RIDERS PER TRIP



Source: SEAT Ridecheck 2014

Performance. Overall productivity on Run 108 is below the systemwide average, largely due to the run's long length and limited ridership activity. On average, 13.2 passengers per revenue hour board Run 108, which is 36% lower than the systemwide average (see Figures 12 and 13). Even on weekends, ridership per hour is below average, with 13.6 Saturday riders per hour and 11.0 Sunday riders per hour.

Run 108 has good on-time performance and is the second most on-time run in the system (see Figure 14). It also is one of the faster runs due to its alignment on the highway.

FIGURE 12 – PERFORMANCE MEASURES

Performance Measure	Weekday		Saturday		Sunday	
	Run 108	System Avg	Run 108	System Avg	Run 108	System Avg
Passengers per Revenue Vehicle Hour	13.2	20.9	13.6	16.4	11.0	12.9
Passengers per Revenue Vehicle Mile	0.5	1.6	0.5	1.2	0.4	0.8
Average Speed (mph)	27.3	16.2	27.3	15.2	27.3	17.6
On-Time Performance Reliability*	74.6%	57.9%	53.1%	52.8%	54.2%	40.8%

*On-Time Performance is the percent of sampled observations where the bus arrived at timepoints within 5 minutes of the scheduled time.
Source: SEAT Analysis Factors 2014

FIGURE 13 – WEEKDAY RIDERS PER REVENUE HOUR

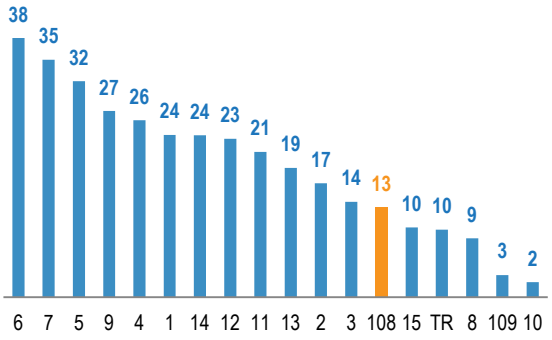
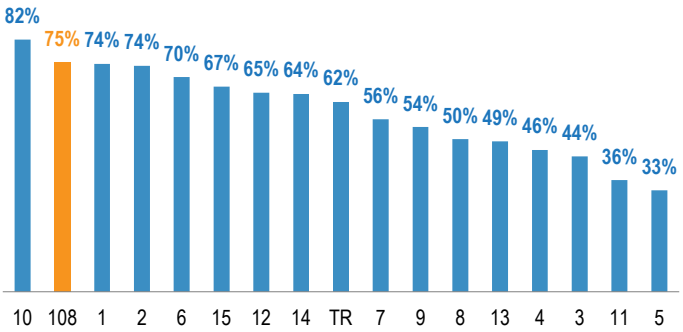


FIGURE 14 – WEEKDAY ON-TIME PERFORMANCE

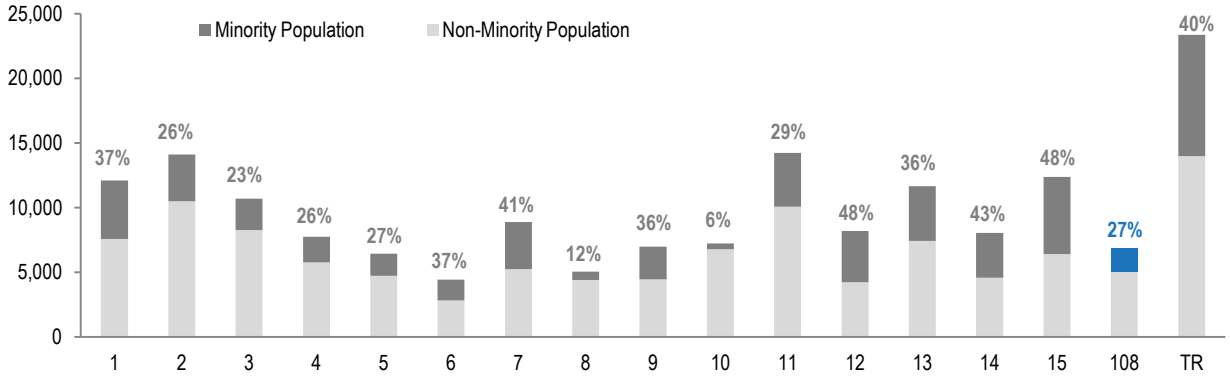


Source: SEAT Ridecheck 2014

Environmental Justice

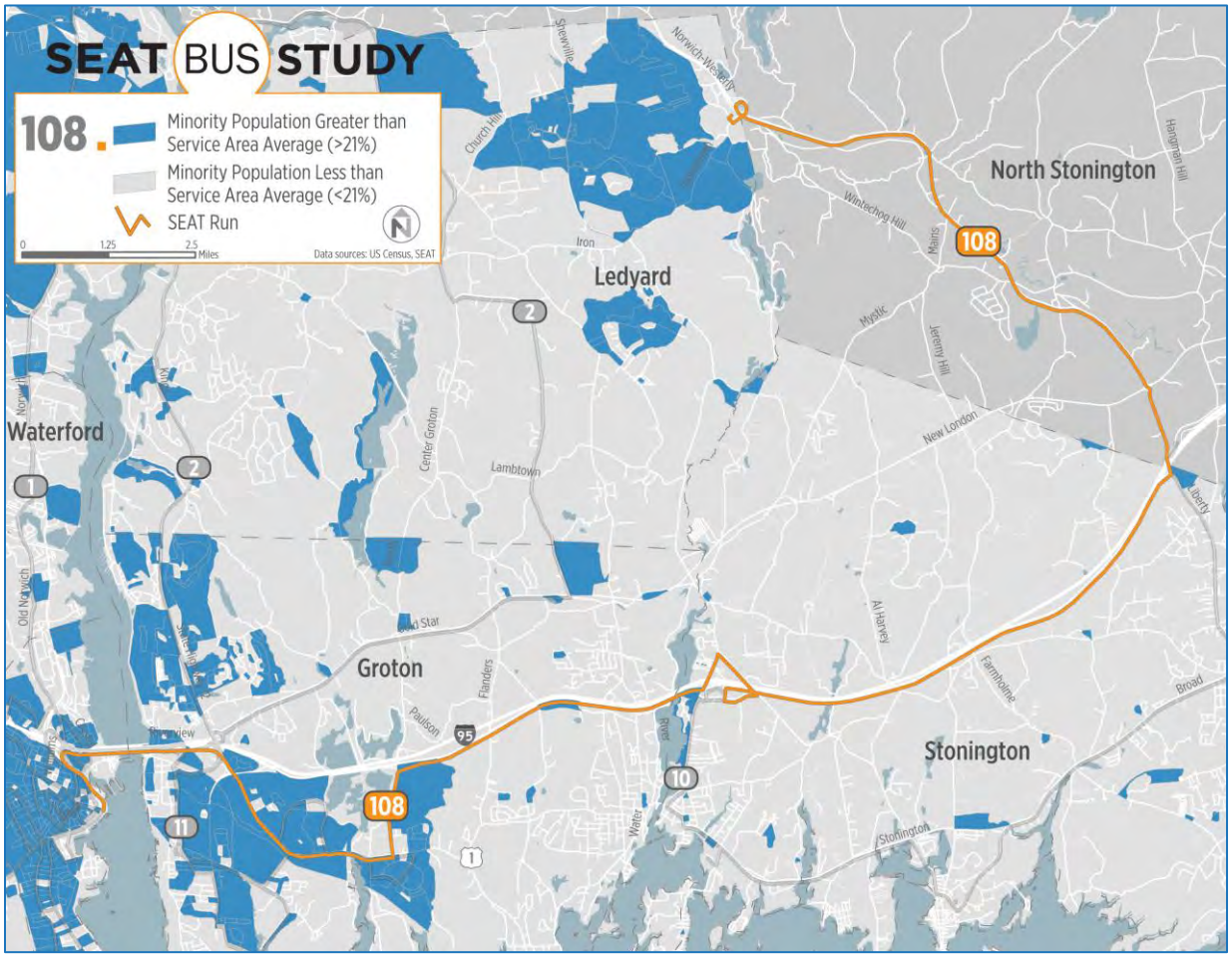
Run 108 predominately serves areas with a slightly higher minority population than is found in the SEAT service area overall. (Because Run 108 runs "closed-door" on I-95 for significant portions of its alignment, these segments were excluded from this calculation.) Just over one-quarter (27%) of the population served by Run 108 lives in census blocks that have a minority population greater than the SEAT average (21%) (see Figure 15). As shown in Figure 16, those minority populations along the run are concentrated in New London and Groton.

FIGURE 15 – SERVICE TO BLOCKS WITH HIGH MINORITY POPULATIONS



Sources: US Census 2010, SEAT

FIGURE 15 – MAP OF BLOCKS WITH HIGH MINORITY POPULATIONS



Sources: US Census 2010, SEAT

SERVICE IMPROVEMENT OPTIONS

Run 108's primary market is likely work trips for the employees of Foxwoods and the hotels and businesses around Olde Mistick Village. The run is less productive than the system average, largely due to its long length and limited ridership. Although Foxwoods Casino is an important regional activity center, it is geographically isolated and very difficult to serve effectively, since any run serving the casino would have a long distance to travel through very transit unsupportive areas. Although Foxwoods is a ridership generator and contributes to the run's ridership, the run should be viewed beyond just serving the casino. Service improvements include the following:

- **Time Connections at Olde Mistick Village with Run 10.** Currently, the connections between Run 10 and Run 108 are untimed, and therefore require that the passenger wait over two hours for a connection between runs. Timing connections between such runs would allow better connectivity to the rest of the service area.
- **Improve branding and awareness of transit options to Foxwoods Resort Casino.** Improved marketing and branding would give visitors of the casino greater awareness of their transit options. Publicizing the service on Foxwoods' own website would allow more visitors to be knowledgeable about additional transit options.
- **Discontinue service to the park-and-ride lot in Pawcatuck.** Run 108 serves the park-and-ride lot in Pawcatuck, though this stop has very little ridership activity. Service to this stop could be discontinued in order to speed service to Foxwoods.
- **Adjust pulse to better match employee shift times.** Run 108 pulses from Union Station in New London on the hour, which may not be ideal for employees traveling to and from work sites near the endpoints with shift times on the hour. If the pulse at Union Station was adjusted to occur on :15 or :45, this may greatly improve the timing of the run and the service's attractiveness for employees.
- **Convert to Limited-Stop Service.** In coordination with a systemwide conversion from flag stops to delineated stops, Run 108 could be converted to a limited-stop service to focus on the most productive service areas and provide the fastest and most convenient service for the travel market between New London, Groton, Mystic, and the casino. For example, a limited-stop service may only stop at the New London Union Station, Groton Square, I-95 at Route 117, Olde Mistick Village, and Foxwoods Casino.
- **Explore partnership funding strategy with Foxwoods Resort Casino.** Foxwoods Resort Casino is responsible for about half of the run's ridership activity, though its remote location and isolation from any other transit service makes it very difficult to serve effectively. A funding partnership could be developed with Foxwoods contributing operating funding to offset the high cost of providing service to this remote location, allowing public funds to be spent on their highest and best use for the greater SEAT community.

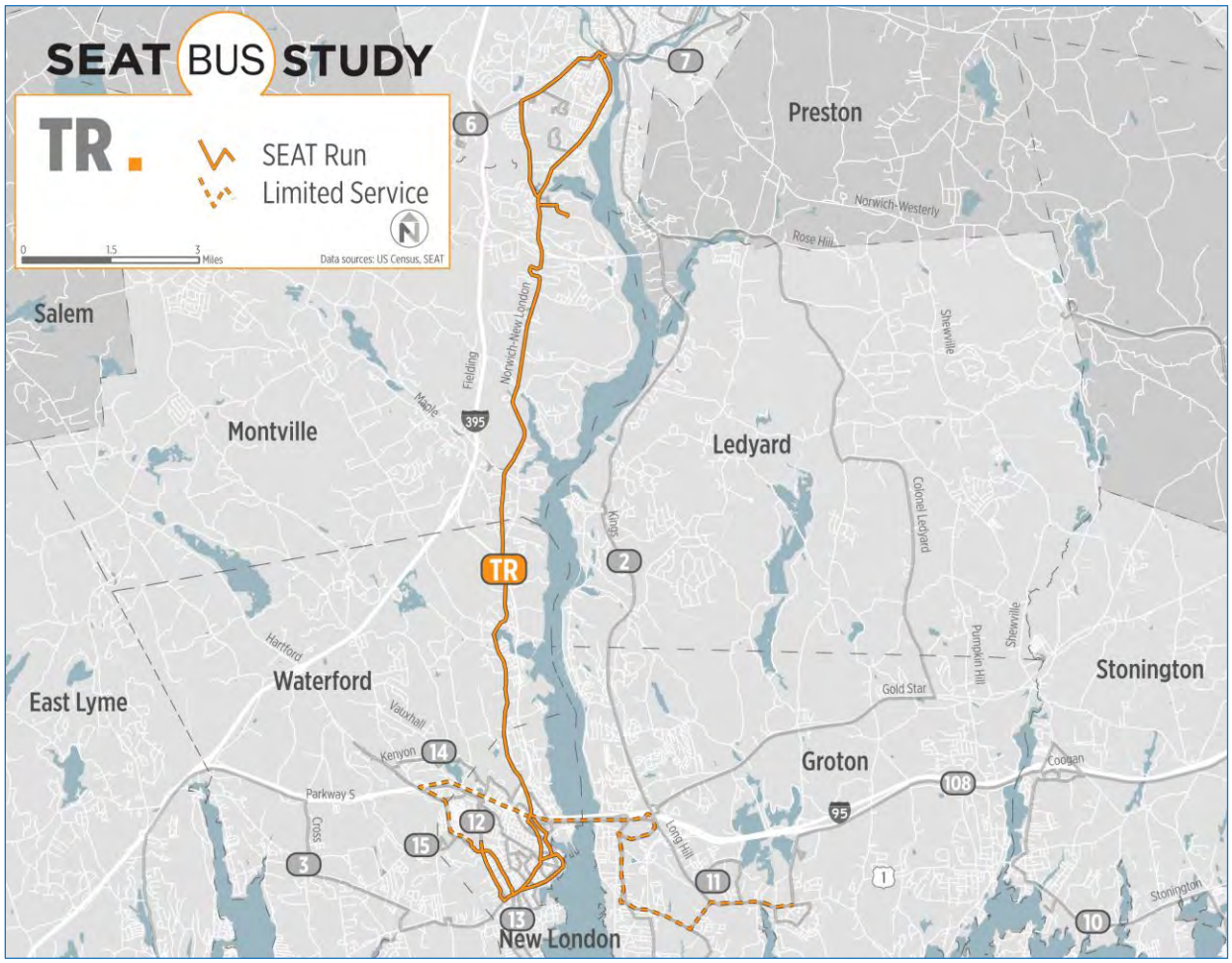
SERVICE EVALUATION

RUN TR (THREE RIVERS COMMUNITY COLLEGE EXPRESS)

Service Design. The Three Rivers Community College Express (TR) is a weekday-only service that operates only when the school is in session and during winter break. The run operates two variants depending on the time of day. Both variants are fairly complex.

The single morning trip serves several local destinations in Groton and New London before terminating at Three Rivers Community College in Norwich. The run begins at Fort Hill Road (Route 1) and Newtown Road (Route 117) in Groton, operates via Fort Hill Road to Plaza Court, before heading southwest on Poquonock Road, then north on Mitchell Street/North Street to I-95. The run then crosses into New London, exiting onto Frontage Road near the New London Shopping Center, using Broad Street and Jefferson Avenue to serve New London High School. At this point, the run heads to central New London via Colman Street, Bank Street, and Water Street to serve New London Union Station. The run then

FIGURE 1 - RUN MAP



continues on Water Street, Governor Winthrop Boulevard, Huntington Street, and continuing on Mohegan Avenue and Highway Route 32, before travelling north as an express service on Interstate I-395. Exiting at West Main Street in Norwich, the run then operates on the New London Turnpike before terminating at Three Rivers Community College.

The three afternoon roundtrips are considerably different from the morning trips and provides significant overlap service to Run 1/101, operating between Norwich Transportation Center and New London. The Three Rivers Express, however, operates from the Norwich Transportation Center via West Main Street and then south on the New London Turnpike to serve the Three Rivers Community College, before continuing southbound via Route 32, Old Norwich Road, Williams Street, and then Crystal Avenue (near Riverside Park), joining Eugene O'Neill Drive, and circling on State Street to end at the New London Union Station. Northbound, the run operates on Governor Winthrop Boulevard, north on Huntington Street, Williams Street, Old Norwich Road, continuing north on Route 32. The run then uses New London Turnpike to serve Three Rivers Community College before looping back on the same street before proceeding north on West Thames Street to the Norwich Transportation Center.

Service Schedule. The Three Rivers Community College Express only operates seven trips per day, one in the morning and three roundtrips (total of six one-ways) in the afternoon. The one morning trip operates only in the northbound direction from Groton to New London and onward to Three Rivers Community College. The morning trip does not serve the Norwich Transportation Center. In the afternoon, there are three trips between New London and the Norwich Transportation Center in each direction every two hours beginning 1:00 PM in the southbound direction and 2:00 PM in the northbound direction.

FIGURE 2 – SCHEDULE STATISTICS

Service Day	Span of Service	Frequency (min) Peak / Off-Peak	Daily Trips
Weekday	7:50 AM — 6:00 PM	120	7
Saturday	-	-	-
Sunday	-	-	-

Source: SEAT Run Schedules

Interaction with System. The Three Rivers Community College Express serves the New London Union Station on all trips and the Norwich Transportation Center during the afternoon. These two transfer points provide onward connections to most other SEAT services. In addition, the Three Rivers Community College Express interacts with the following runs:

- Run 1/101, which connects Norwich with New London, provides parallel service on a significant portion of the run. In the morning, the Three Rivers Express provides supplemental service on Mohegan Avenue (Highway Route 32), however uses Interstate I-395 between Quaker Hill and Norwich, bypassing all other stops. In the afternoon, however, the Three Rivers Express operates on Highway Route 32 for most of its alignment except between New London and Quaker Hill, where it uses Old Norwich Road and Williams Street instead of Mohegan Avenue.
- Run 12 operates northbound Jefferson Avenue, which overlaps with the Three Rivers Express's morning service to New London High School.
- Run 14 operates southbound on Colman Street, which overlaps with the Three Rivers Express's morning trip from New London High School.
- Run 7 operates on West Main Street and West Thames Street (Norwich) in the opposite direction of the Three Rivers Express service.

Ridership by Service Day. The Three Rivers Community College Express run has a fairly low ridership given that it targets a single ridership group and its limited hours of service. On average, 52 people use the service per day, an average of 7.4 per trip. This is below the systemwide weekday average of 13.0. Consequently, the Three Rivers Community College Express ranks fourth lowest in terms of ridership per trip and fourth lowest in overall total ridership. However, this service was first introduced in 2013, and ridership has begun to increase significantly since 2014.

FIGURE 3 - RIDERSHIP STATISTICS

Service Day	Daily Ridership	Ridership per Trip	
	Run TR	Run TR	System Avg
Weekday	52	7.4	13.0
Saturday	-	-	9.5
Sunday	-	-	5.8

Source: SEAT Ridecheck 2014

FIGURE 4 - AVERAGE WEEKDAY RIDERSHIP

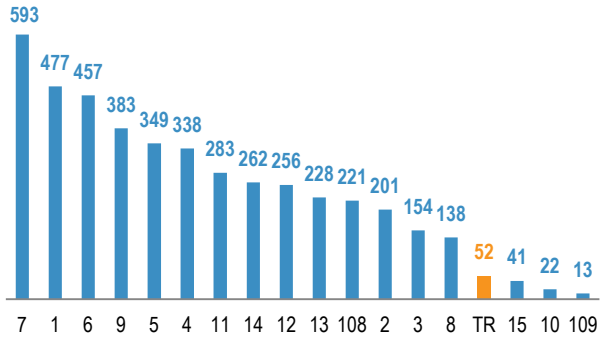
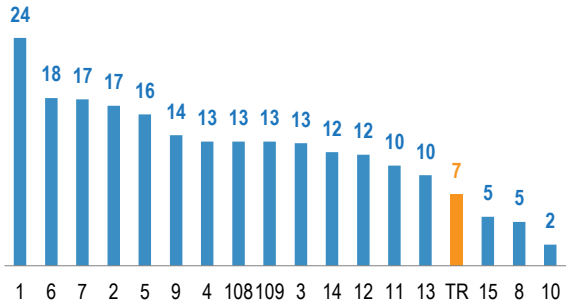


FIGURE 5 - AVERAGE WEEKDAY RIDERSHIP PER TRIP



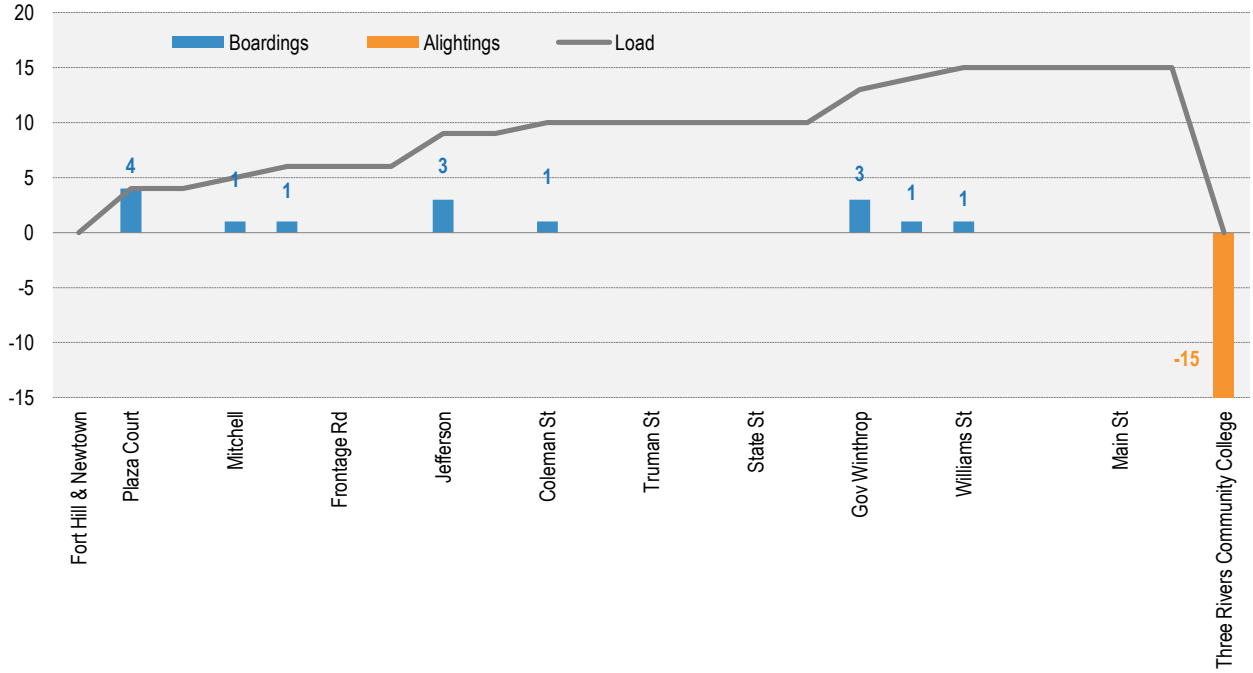
Source: SEAT Ridecheck 2014

Ridership by Stop. Ridership is primarily focused at the two ends of the run. The following locations have comparatively high levels of activity:

- **Three Rivers Community College.** In the morning, 15 passengers disembark at this stop. In the afternoon, there are 8 southbound boardings and 2 alightings. In contrast, there are no northbound boardings and alightings. This is most likely due to the fact that Run 7 offers more direct service between Three Rivers Community College and Norwich Transportation via West Main Street. Run 7 also arrives at approximately the same time as the Three Rivers Community College Express and thus competes for passengers.
- **New London Union Station.** There are 14 boardings and 8 alightings per day on the run's afternoon trips. There are no passengers at this stop during the morning.
- **Norwich Transportation Center.** There are 14 boardings and 7 alightings at Norwich Transportation each day during the afternoon trips.

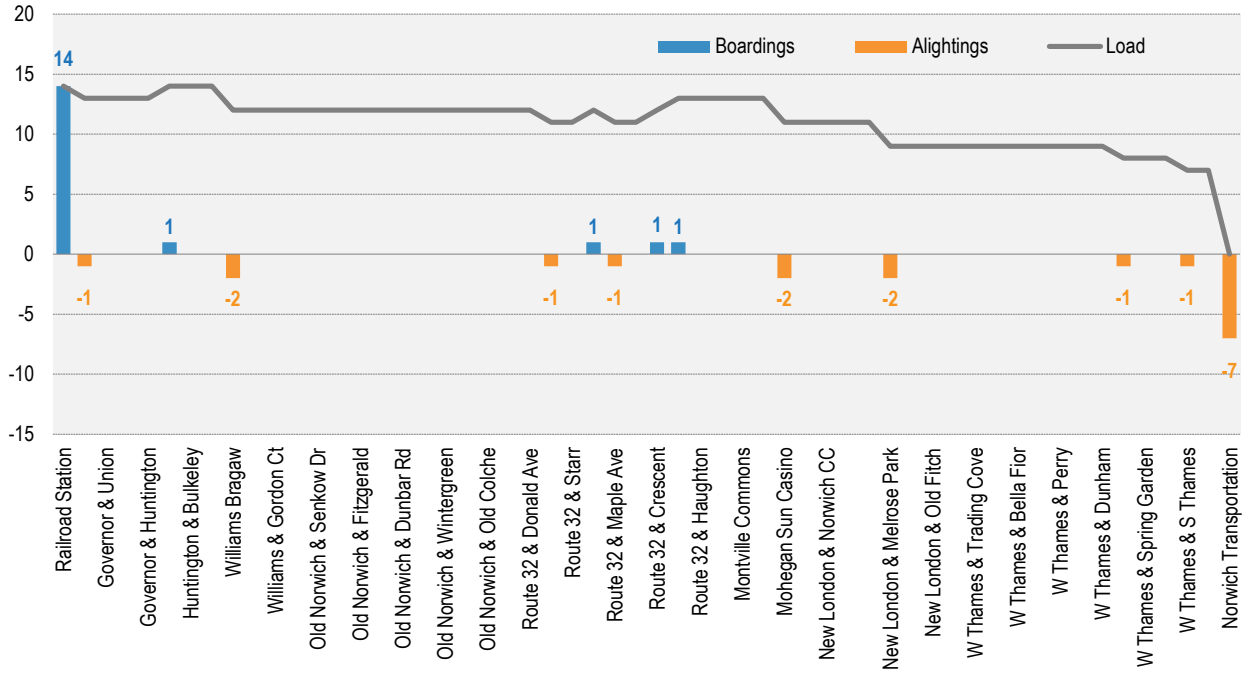
Despite the run's intention to serve Three Rivers Community College, there are no northbound afternoon riders. This is likely due to the fact that Run 7 provides a more direct connection from TRCC to the Norwich Transportation Center and possibly due to the students' class schedules and the desire to arrive at school at the beginning of the day. Thus, the northbound trips effectively act as a supplemental service to Run 1/101.

FIGURE 6 – NORTHBOUND WEEKDAY AM PEAK RIDERSHIP BY STOP CHART



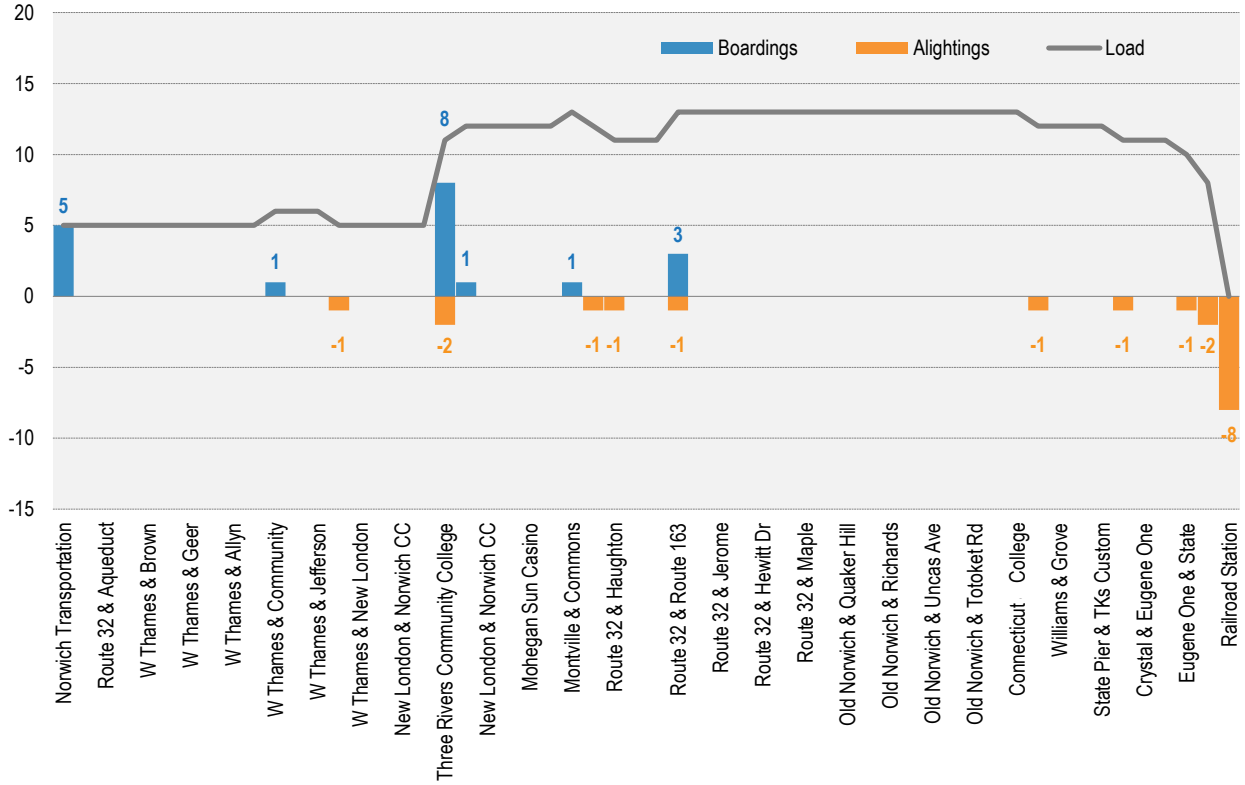
Source: SEAT Ridecheck 2014

FIGURE 7 – NORTHBOUND WEEKDAY RIDERSHIP BY STOP CHART



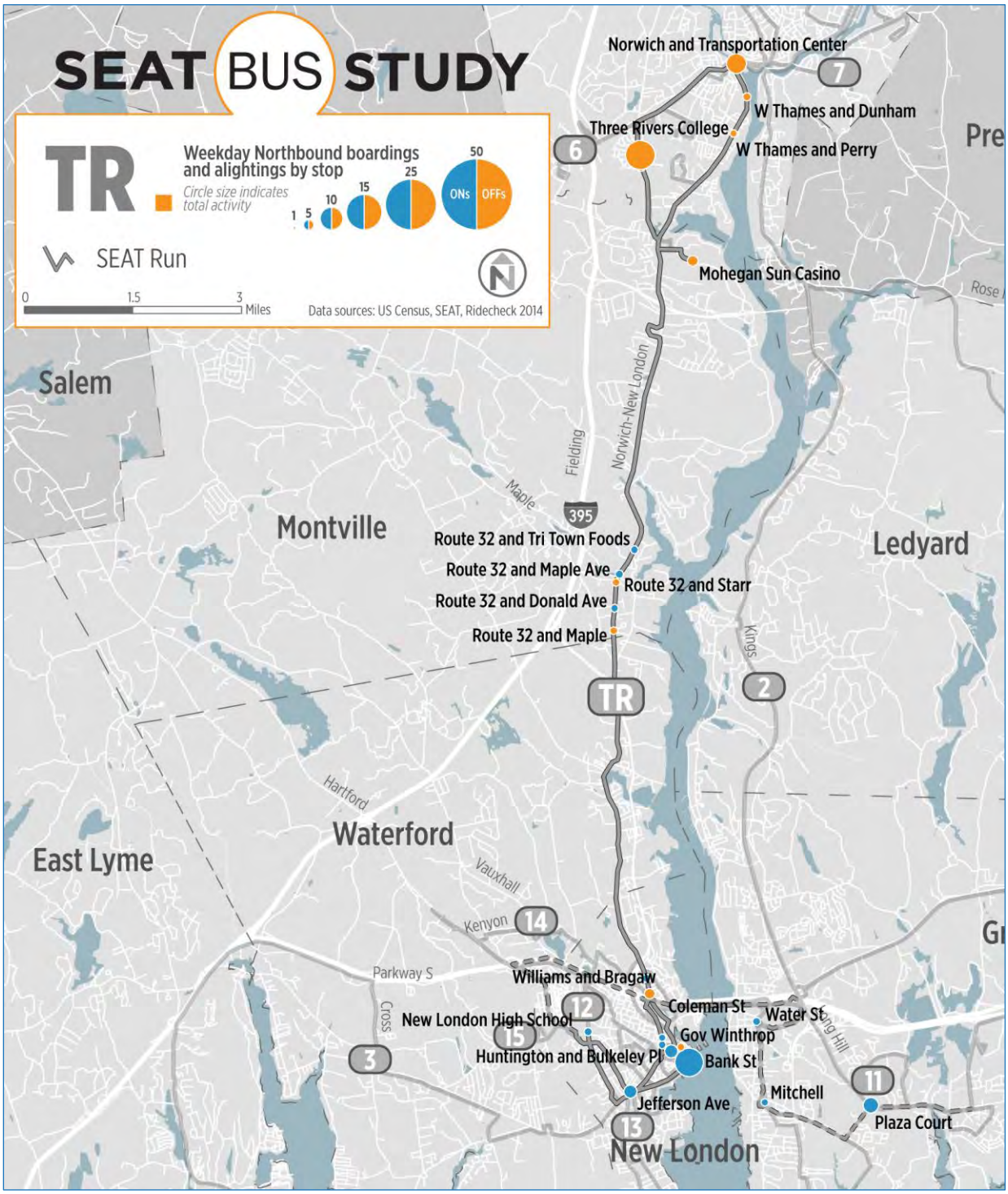
Source: SEAT Ridecheck 2014

FIGURE 8 – SOUTHBOUND WEEKDAY RIDERSHIP BY STOP CHART



Source: SEAT Ridecheck 2014

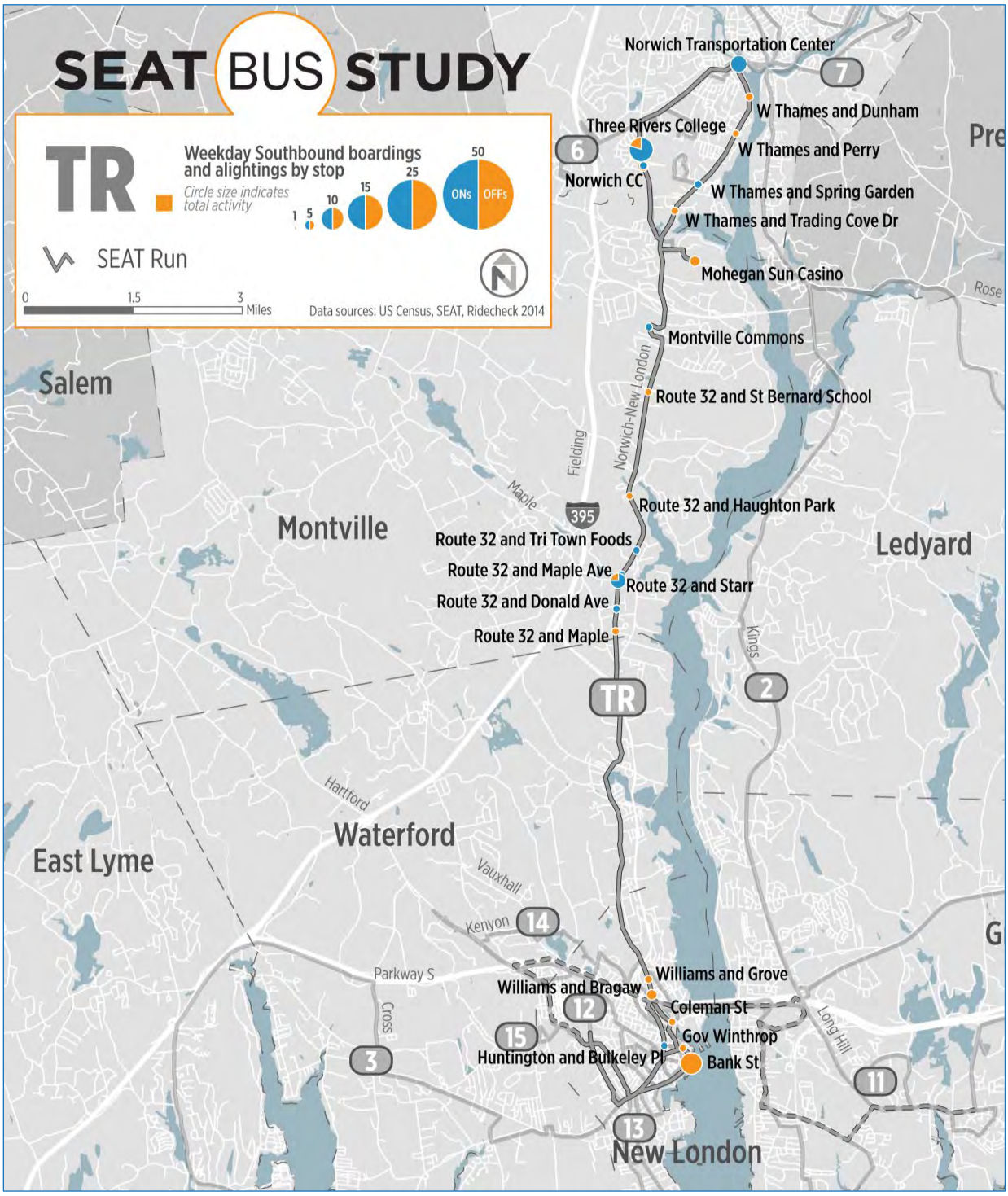
FIGURE 9 – NORTHBOUND WEEKDAY RIDERSHIP BY STOP MAP



Note the map does not show the AM trip that provides express service along I-395.

Source: SEAT Ridecheck 2014

FIGURE 10 – SOUTHBOUND WEEKDAY RIDERSHIP BY STOP MAP



Source: SEAT Ridecheck 2014

Ridership by Trip. Ridership on the Three Rivers Community College Express is highest on the single 7:50 AM trip. This is the only morning trip from New London with direct service to the college. The afternoon service has less riders per trip compared to the morning. Ridership on the afternoon trips gradually increases throughout the afternoon. Ridership is highest on the last two trips of the day at 5:00 PM and 6:00 PM when ridership peaks at 7 and 8 riders respectively.

FIGURE 11 – NORTHBOUND WEEKDAY RIDERS PER TRIP

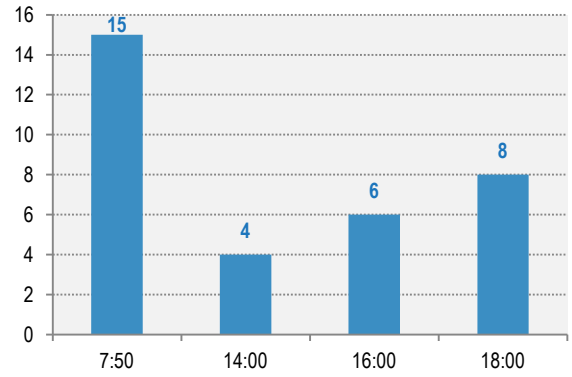
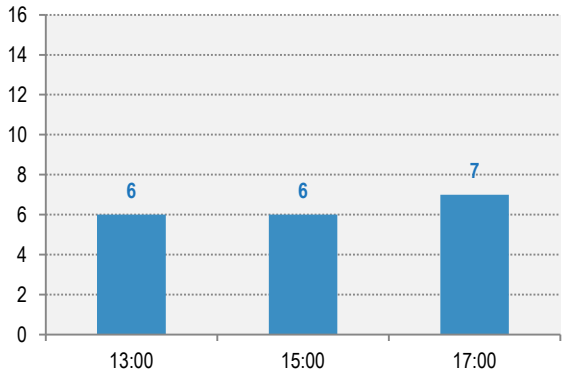


FIGURE 12 – SOUTHBOUND WEEKDAY RIDERS PER TRIP



Source: SEAT Ridecheck 2014

Performance. Overall, the Three Rivers Community College Express performs below the system average on ridership productivity. It carries an average of 9.9 passengers per revenue hour, less than half of the systemwide average of 20.9. Its speed, however, is far above others due to its use of Interstate I-395 during the morning and low number of passengers (meaning less stops). Despite the high operational speed, the run has an on-time performance of 61.7%. Although the line has a higher on-time performance than the systemwide average, reliability is still an issue on this run, likely due to peak period traffic congestion and a complicate run alignment with multiple service variants.

FIGURE 13 - PERFORMANCE MEASURES

Performance Measure	Weekday		Saturday		Sunday	
	Run TR	System Avg	Run TR	System Avg	Run TR	System Avg
Passengers per Revenue Vehicle Hour	9.9	20.9	-	16.4	-	12.9
Passengers per Revenue Vehicle Mile	0.2	1.6	-	1.2	-	0.8
Average Speed (mph)	53.3	16.2	-	15.2	-	17.6
On-Time Performance Reliability*	61.7%	57.9%	-	52.8%	-	40.8%

*On-Time Performance is the percent of sampled observations where the bus arrived at timepoints within 5 minutes of the scheduled time.
Source: SEAT Analysis Factors 2014

FIGURE 14 – WEEKDAY RIDERS PER REVENUE HOUR

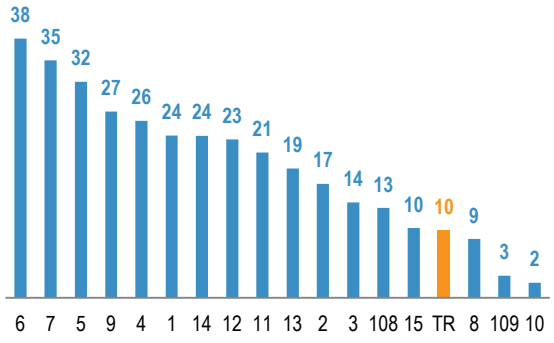
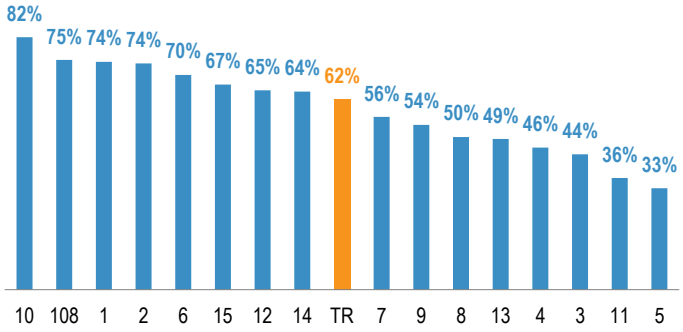


FIGURE 15 – WEEKDAY ON-TIME PERFORMANCE

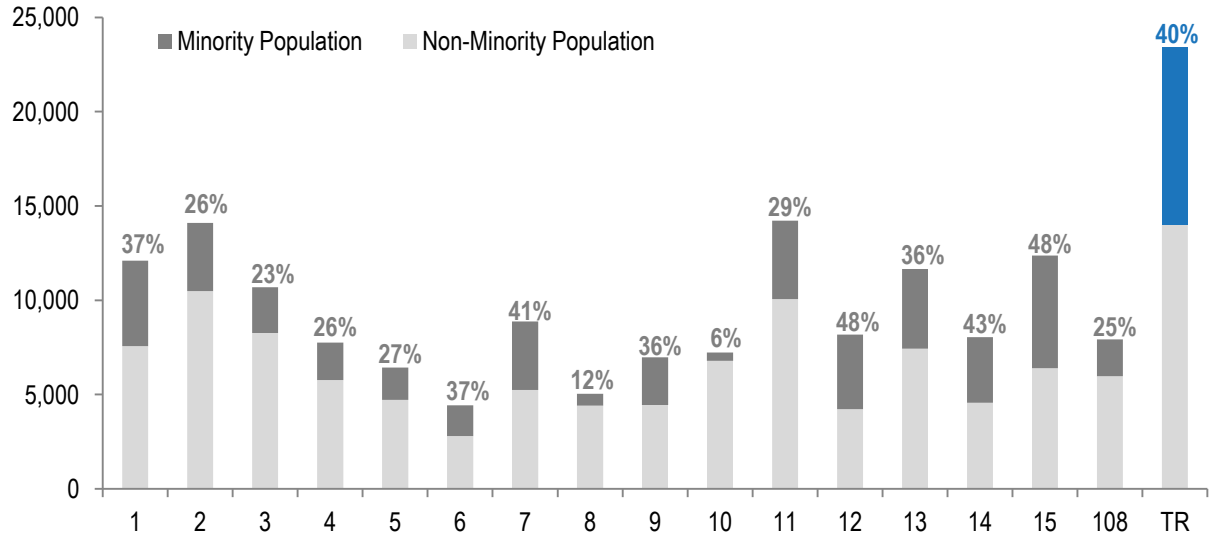


Source: SEAT Ridecheck 2014

Environmental Justice

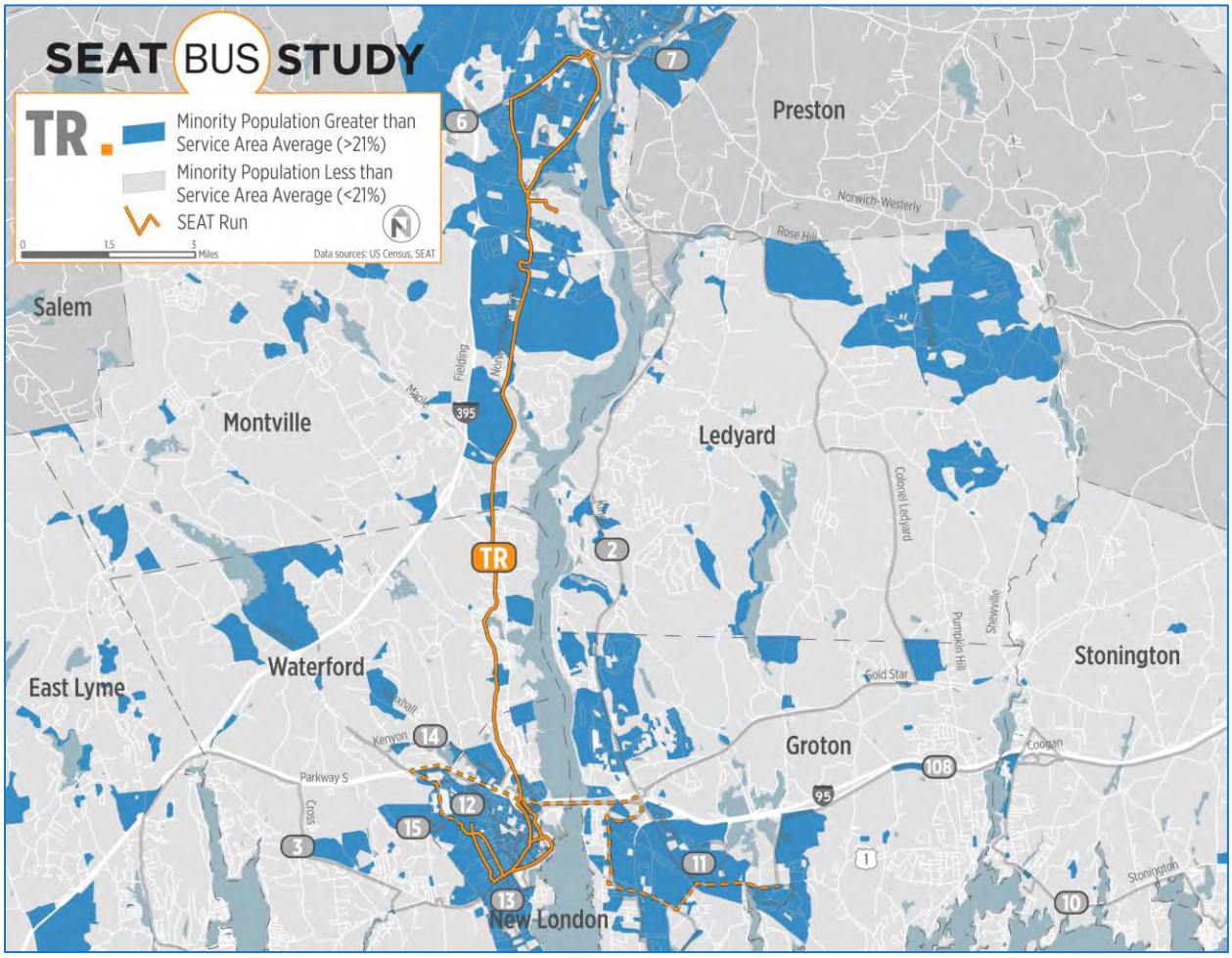
The Three Rivers run serves areas with a higher minority population than is found in the SEAT service area overall. Approximately 40% of the population served by this run lives in census blocks that have a minority population greater than the overall service area average (21%). As shown in Figure 17, these minority populations are concentrated in downtown Groton, New London and Norwich, and along Highway Route 32 in Montville. However, the result is somewhat misleading because while the run's alignment does travel through high minority areas, the run is not serving these populations; the run's primary market is students of the Three Rivers Community College.

FIGURE 16 – SERVICE TO BLOCKS WITH HIGH MINORITY POPULATIONS



Sources: US Census 2010, SEAT

FIGURE 17 – MAP OF BLOCKS WITH HIGH MINORITY POPULATIONS



Sources: US Census 2010, SEAT

SERVICE IMPROVEMENT OPTIONS

The Three Rivers Community College Express has very few riders per trip and revenue hour compared to the rest of the system despite serving some major activity centers. The biggest challenge is the fact that the run tries to target the run only to TRCC students instead of making it a service attractive for all riders. However, despite this goal, the schedule is not well aligned with the TRCC class schedule. For example, the 6:00 PM express bus arrives on campus at 6:45 PM, which is just 15 minutes too late for the 6:30 PM start of evening classes, but the 4:00 PM express bus would arrive nearly two hours before the start of class. Targeting other passengers to use the service in addition to TRCC students would create a more successful run. Strategies include:

- **Consolidate with Run 1.** Run 1 provides parallel service on a significant portion of the run. Consolidating the services into a unified Run 1 would allow other people to use the service, and to provide better access along the corridor as a whole. Currently, the services are branded as separate lines despite similar alignments. Having the Three Rivers Community College Express schedule on the same page as Run 1/101 would demonstrate that the corridor has much more frequency than currently perceived.

- **Operate as peak express service complementing Run 1.** To better complement Run 1, the Three Rivers Service could operate as a limited stop peak period service between Groton and Norwich.
  - **Move service to Highway Route 32 from Old Norwich Road.** There are no riders who board on the Old Norwich Road alignment in Waterford and New London. Moving the alignment to Highway Route 32 (Mohegan Avenue) would allow for more consistent service that would complement Run 1.
  - **Operate directly from TRCC to Norwich instead of backtracking on West Thames.** Currently, northbound trips use New London Turnpike to access Three Rivers Community College before backtracking and then proceeding again northbound on West Thames Street. This causes additional run time due to the backtracking. Continuing from Three Rivers Community College on West Main Street would provide more direct service to the Norwich Transportation Center.
  - **Extend morning run into the Norwich Transportation Center.** Continuing AM northbound trips into downtown Norwich would make this service more attractive to other riders in addition to students.
- **Adjust schedule to better correlate with night classes.** The 6:00 PM bus arrives at campus at 6:45 PM, which is 15 minutes after the start of 6:30 PM night classes. The 4:00 PM trip arrives at 4:45 PM, which is too early. A 5:00 PM or 5:30 PM trip would arrive on campus at 5:45 or 6:15 PM and attract more students. Most night classes end at 9:15 pm, allowing students to catch the last run into New London (with a few classes extending to 9:50 pm after this trip).
- **Extend evening southbound service to Groton.** The northbound morning trip originates in Groton, but southbound afternoon and evening services terminate in New London. At least one evening or late night trip could be extended to Groton. Alternatively, the run could connect with service at the New London Union Station to provide transfers to Groton in the evening.
- **Uncouple the Groton/New London High School Service.** The southern portion of the run acts more of a collector for service heading to Three Rivers Community College. Instead of having the run loop around through New London, it may be more effective and more direct for most passengers to connect from other services at New London Union Station for the onward service to Three Rivers Community College.

APPENDIX C

Summary of SEAT Bus Study Public Involvement

SUMMARY OF PUBLIC OUTREACH

Throughout the SEAT Bus Study, giving everyone in the community an opportunity to participate was a top priority. The project team provided as many ways as possible to interact, allowing people to share ideas and feedback in whatever way is most convenient and comfortable for them. Through a variety of online and in-person activities, there have been multiple ways for community members to express their ideas and communicate their feedback, giving everyone a chance to be heard.

The following provides a summary of the events and public engagement strategies employed throughout the SEAT Bus Study, and also highlights the major themes that emerged from comments and conversations with the public.

Priority Issues

➲ **Make service faster and more direct.** Most respondents communicated that travel by transit takes a very long time, and round-trip travel can consume a major portion of the day. Respondents pointed out that many routes are indirect and circuitous, traveling out of the way and making trips longer than they would prefer.

➲ **Improve the quality and legibility of public information materials.** Respondents overwhelmingly expressed a need for better information materials, including schedules, maps, and website. Respondents also asked for better signage at stations and major stops, as well as real-time arrival information accessible on mobile devices.

➲ **Make service more reliable.** Respondents expressed frustration with service that is unreliable, frequently encountering buses that run late and lead to missed transfers at pulse points. With one-hour service frequencies and at least one transfer required for many trips across the SEAT system, on-time performance is a critical issue for riders.

➲ **Add more evening and weekend service.** Most respondents asked for more service later in the evenings, as well as more service on Saturdays and Sundays.

Stakeholder Interviews

A series of stakeholder interviews were conducted during the early phases of the study to better understand how members of the community perceive SEAT service. Interviews were conducted with 22 key stakeholders and representatives of organizations with clients that use SEAT.

Community Meetings

Community meetings were during each round of public involvement, with meetings held in Norwich and New London. Meetings were advertised on the project website, on bus card announcements on SEAT buses, and through emails sent to community stakeholders and individuals who signed up for project update emails.

Rather than providing a formal presentation, the community meetings were held as informal, workshop-style events where participants had the opportunity to learn about the potential service options, speak with the project team and local officials, and provide feedback in a variety of ways, including voting exercises, written comments, and a survey.

- Norwich Transportation Center, February 24, 2015
- New London Union Station, February 25, 2015
- New London Union Station, July 27, 2015
- Norwich Transportation Center, July 28, 2015

Mobile Workshops

In addition to community meetings, the project team also visited major transit stops to speak with riders and hear feedback. Tabling events were held at key locations, where riders could view maps, participate in interactive voting exercises, and talk one-on-one with members of the project team. A workshop bus was brought to several stops, featuring a SEAT transit bus outfitted with uniquely branded banners outside the bus and workshop materials inside. Riders were invited on board the bus to learn more about the SEAT Bus Study, talk with project staff, and participate in voting exercises. Mobile workshop events were held at the following locations:

Round 1:

- Griswold Senior Center, February 24, 2015
- Three Rivers Community College, Norwich, February 24, 2015
- Norwich Transportation Center, February 24, 2015
- New London Union Station, February 25, 2015

PUBLIC OUTREACH BY THE NUMBERS

- ✓ 4 public meetings
- ✓ 9 outreach events, including workshop bus and tabling at key transit centers
- ✓ 144 written comments submitted at meetings and events
- ✓ 525 votes received through voting exercises at all events
- ✓ 22 interviews with stakeholders
- ✓ 316 completed tradeoff surveys
- ✓ 89 comments submitted through the SEAT Bus Study website

- Crystal Mall, Waterford, February 25, 2015
- Groton Plaza Court, February 25, 2015

Round 2:

- New London Union Station, July 27, 2015
- Groton Plaza Court, July 28, 2015
- Norwich Transportation Center, July 28, 2015

Voting Exercises

During each round of public outreach, the project team developed interactive voting exercises that allowed participants to select which types of service improvements they wanted. Limited in the number of "votes" they had, each participant prioritized the improvements were most important to them, such as "More Direct Service," or "Better Information." These exercises allowed participants to easily identify which improvements were most important to them and to communicate their priorities.

Website and Online Engagement

The SEAT Bus Study website (www.SEATBusStudy.com) provides easy access to information about the study and its progress, and served as a convenient way for people to share written comments and feedback. Announcements about public events were shared via email with people who signed up to receive project notices. A tradeoff survey was also administered online, which allowed respondents to quickly and easily identify the service priorities that are most important to them.

WHAT WE HEARD

➲ **Make Service More Direct.** Respondents overwhelmingly asked for more direct service. Several said that it takes a long time to make a trip using SEAT, consuming a significant amount of time for riders and dissuading many non-riders from using transit. Several routes were described as circuitous, traveling out-of-the-way or in large loops, and difficult to understand. Routes mentioned include local routes serving both Norwich and New London, the leg of Run 2 serving Ledyard Center, and Run 1. There was strong support among respondents for making Run 1 a faster and more direct connection between Norwich and New London, with more frequent service – hourly service throughout the day was identified as a significant potential improvement.

➲ **Increase Service Frequency.** Frequency emerged as a major issue that impacts several other service challenges in the SEAT system. Many respondents requested that buses run more often than once an hour on some routes. Increasing service on runs with high ridership was a popular strategy, and hourly service on Run 1 in particular was frequently mentioned. Long wait times were frequently cited as a major challenge for riders due to low service frequencies. Low frequencies also exacerbate long wait times resulting from late buses and missed transfers.

➲ **Improve Reliability.** Several respondents identified reliability and on-time performance as a critical issue. This is particularly important for a system that operates on a pulse schedule as SEAT does, where transfers are necessary to complete longer trips across the service area. Late buses can lead to missed connections, leading to long wait times with no alternative options. Although reliability/on-time performance was not provided as an option for voting, many respondents explicitly mentioned reliability as a major issue that needs to be addressed to improve SEAT service.

➲ **Extend Span of Service.** A significant share of respondents requested longer span of service for SEAT routes, particularly later evening service on weekdays. Many indicated that service ends too early, especially considering work schedules and the need to reach second-shift employment, as well as students who take evening classes.

➲ **Increase Weekend Service.** Respondents asked for more weekend service. Many stated that service currently ends too early on Saturdays, especially in Norwich. An overwhelming share of respondents also requested more service on Sundays throughout the SEAT system.

➲ **Improve Public Information Materials.** One of the most popular suggestions f[rom respondents was to improve SEAT information materials. Many urged that schedules be redesigned to be clearer and easier to understand, with some stating that current schedules are "barely legible"; some participants stated that they were interested in using different routes or trying SEAT service for the first time, but could not understand where the routes went or when they would operate based on existing information. In addition, many respondents found the website "clunky," and had difficulty finding the information they were looking for. Respondents asked that easy-to-understand maps and schedules be available online, as well as at bus stops so that riders could know when a bus is scheduled to arrive.

➲ **Establish Fixed Stops and Eliminate Flag Stop System.** Discontinuing the current flag stop system and creating fixed bus stops was among the most supported ideas. Several respondents noted that having bus stops would be helpful for knowing where and when the bus would come. Respondents also asked that route schedules be provided at bus stops, in addition to a sign that states which route(s) will serve that stop. Some respondents suggested that fixed stops would be helpful in the more urbanized areas, but that flag stops could still be useful in more rural areas where walking conditions are less safe.

➲ **Improve Fare Payment Options.** Respondents want more options for fare payment, including unlimited passes for regular riders. Respondents specifically asked for weekly and especially monthly passes, as well as a U-Pass where students could acquire a bus pass on a semester basis, through either SEAT or their school. Reloadable passes were also requested. In addition, respondents asked that tickets and passes be sold at more locations, including at colleges and additional retail establishments. Finally, respondents supported eliminating the current system of multiple zones and establishing a single system-wide fare to reduce confusion and make service simpler and easier to understand.

Additional Feedback

➲ **Add or Coordinate Service to New Areas.** Some respondents requested service to new areas, and better coordination with other service providers in the region. Hartford was frequently mentioned as a desired destination, with requests to coordinate service between the SEAT system and CT*transit*-Hartford, possibly through a coordinated connection in Colchester. Additional locations included Colchester, Sprague, and Plainfield.

➲ **Improve Driver Behavior Toward Riders with Disabilities.** A number of respondents cited negative attitudes by drivers toward riders with disabilities. Respondents requested that drivers be knowledgeable of ADA requirements and standards, and many asked that drivers be more respectful of riders who have disabilities.

APPENDIX D

Service Design Guidelines

SEAT BUS STUDY

SERVICE GUIDELINES

October 2015

SCCOG SEAT CONNECTICUT DEPARTMENT OF TRANSPORTATION

NELSON NYGAARD ASG PLANNING

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1 INTRODUCTION

The Southeast Area Transit District (SEAT) strives to provide quality transit service in a cost-effective manner that is consistent and equitable. To do so, SEAT must make a number of competing decisions on where demand is greatest, on which types of service would work best and be most appropriate, and where limited resources can and should be used. To do this, SEAT has developed this set of service guidelines that will be used to:

- Determine where service should be provided
- Design service
- Determine appropriate service levels
- Measure and establish minimum levels of service performance

The service guidelines will be applied to the entire family of services provided by SEAT and are intended to bring clarity and consistency to the process of continually adjusting and improving transit services to meet varied and changing customer needs. This document addresses the design and scheduling of service and does not address amenities at transit stops and stations.

In most cases, the service guidelines define minimum thresholds that must be met, and most services would exceed the minimum thresholds. However, the guidelines are also designed to—within limits—provide flexibility to respond to varied customer needs and community expectation in an accountable, equitable, and efficient manner.

Finally, it should be noted that adherence to these service guidelines is dependent upon resource availability, and in particular, the amounts of funding provided by SEAT's local partners. These guidelines are applicable to the System Expansion Plan developed as part of the SEAT Bus Study, which provides for increases to SEAT's operating budget. However, the two Cost Neutral Plans developed as part of the study fall short of some of the guidelines established here. In the event of constrained resources, SEAT will meet these guidelines as closely as possible and will work to achieve consistency as resources permit.

2 SEAT SERVICES

A hierarchy of SEAT services has been developed to reflect the array of travel markets and customer needs within the Southeastern Connecticut region. Five different route classifications have been identified to help guide the design and scheduling of service for general public transit routes. These categories include:

1. Key Routes
2. Regional Connector Routes
3. Local Routes
4. Community Routes
5. Special Services

The specific routes included in each category are shown in Section 6. Complementary ADA paratransit services must be designed in accordance with specific federal guidelines and are not addressed in this document.

KEY ROUTES

Key Routes serve high ridership corridors that provide the backbone of the SEAT system. These routes operate along primary arterials and offer simple, straight, and direct service. Key routes are targeted for passenger amenities, service enhancements, intersection improvements, and other potential transit enhancements as may be identified on a case-by-case basis.

REGIONAL CONNECTOR ROUTES

Regional Connectors are designed primarily to provide fast and direct service between the region's key downtown cores and major activity centers. Regional connector routes provide high-speed service, use freeways or major arterials, and make limited stops to provide more predictable, faster trips. These routes generally operate on weekdays only and operate a limited number of trips, but depending upon demand, some routes may operate for longer hours and/or on weekends.

LOCAL ROUTES

Local Routes are local fixed routes that operate entirely or primarily in densely developed areas, which is where the demand for transit is the highest. Most of these routes operate primarily in New London, Norwich, and Groton. Local routes provide the core of SEAT's local service, providing no less frequent than hourly service throughout the day on weekdays.

COMMUNITY ROUTES

Like local routes, community routes provide local, fixed-route service. However, these routes generally provide service outside of densely developed urban areas, where there is lower demand for transit. Community routes generally operate less service while still providing connections to the rest of the SEAT system, although additional service may be provided on these routes as demand warrants.

SPECIAL SERVICES

SEAT may also operate other specialized services, such as a seasonal shuttle or flexible service, to meet demand from a specific need or event. Special services would also provide connections to the larger SEAT system.

3 SERVICE DESIGN GUIDELINES

SEAT strives to serve as many residents, workers, and visitors in Southeastern Connecticut as it can with its available resources. Service elements that will attract one type of rider to transit can deter other riders, and SEAT must balance these types of competing demands. However, there are also certain service design principles that will improve service for nearly all riders; this section describes the guidelines for these principles.

SERVICE SHOULD BE SIMPLE

For people to use transit, service should be designed so that it is easy to understand. In this way, current and potential riders can grasp and use the transportation options available to take them where and when they want to go with ease. Most of the guidelines in this section are aimed at making service intuitive, logical, and easy to understand.

ROUTES SHOULD OPERATE ALONG A DIRECT PATH

Passengers and potential passengers alike prefer faster, more direct transit services. In SEAT's quest to remain competitive with the automobile, special attention should be placed on designing routes to operate as directly as possible to maximize average speed for the bus and minimize travel time for passengers while maintaining access to service. Routes should not deviate from the most direct alignment unless there is a compelling reason. Directness of service is affected by a series of factors, some under SEAT's control, and others due to the environment in which service operates. Some of these factors include:

SERVICE FACTORS WITHIN SEAT'S CONTROL

- Directness of individual routes (meandering)
- Connectivity throughout route network (transfers)
- Operating characteristics (number of stops, express/local operation, etc.

ENVIRONMENTAL FACTORS BEYOND SEAT'S CONTROL

- Traffic congestion
- Geography
- Accessibility of streets from adjacent areas
- Street geometry and turning movements
- Traffic signals and controls

ROUTE DEVIATIONS SHOULD BE MINIMIZED

As described above, service should be relatively direct. The use of route deviations—the deviation of service off of the most direct route—should be minimized.

However, there are instances when the deviation of service off of the most direct route is appropriate, for example to avoid a bottleneck or to provide service to major shopping centers, employment sites, schools, etc. In these cases, the benefits of operating the route off of the main route must be weighed against the inconvenience caused to passengers already on board. Route deviations should be implemented only if:

1. The deviation will result in an increase in overall route productivity.
2. The number of new passengers that would be served is equal to or greater than 25% of the number of passengers who would be inconvenienced by the additional travel time on any particular deviated trip.
3. The deviation would not interfere with the provision of regular service frequencies and/or the provision of coordinated service with other routes operating in the same corridor.

In most cases, where route deviations are provided, they should be provided on an all day basis. Exceptions are during times when the sites that the route deviations serve have no activity—for example route deviations to shopping centers do not need to serve those locations early in the morning before employees start commuting to work.

MAJOR TRANSIT ROUTES SHOULD OPERATE ALONG ARTERIALS

Rapid bus, key corridor, and urban radial routes should operate on major roadways and should avoid deviations to provide local circulation. Riders and potential transit users typically have a general knowledge of an area's arterial road system and use that knowledge for geographic points of reference. The operation of bus service along arterials makes transit service faster and easier for riders to understand and use.

ROUTES SHOULD BE SYMMETRICAL

Routes should operate along the same alignment in both directions to make it easy for riders to know how to return to their trip origin location. When a route operates in a one-way loop, offering service in only one direction, passengers are forced to travel out of their way on at least one segment of their round trip. Exceptions can be made in cases where such operation is not possible due to one-way streets or turn restrictions. In those cases, routes should be designed so that the opposite directions parallel each other as closely as possible.

ROUTES SHOULD SERVE WELL-DEFINED MARKETS

To make service easy to understand and to eliminate service duplication, service should be developed to serve well-defined markets. Ideally, major corridors should be served by only one route of each route type—for example, one regional connector route and one local route, and not by multiple regional connector routes and multiple local routes. However, exceptions can and should be made when multiple routes should logically operate through the same corridor to unique destinations.

SERVICES SHOULD BE WELL-COORDINATED

When multiple routes operate through the same corridor but to different destinations, service should be coordinated to maximize its utility and minimize redundancy. To avoid bunching of buses and to balance loads, major routes of the same route type that serve the same corridor should be scheduled to operate at the same service frequencies and should alternate trips at even intervals.

SERVICE SHOULD BE CONSISTENT

Routes should operate along consistent alignments and at regular intervals (headways). People can easily remember repeating patterns but have difficulty remembering irregular sequences.

For example, routes that provide four trips an hour should depart from their terminals every 15 minutes. Limited exceptions can be made in cases where demand spikes during a short period in order to eliminate or reduce crowding on individual trips.

Most routes intersect with other routes at transfer centers, stations, and street intersections. At major transfer locations, schedules should be coordinated to the greatest extent possible to minimize connection times for the predominant transfer flows.

STOPS SHOULD BE SPACED APPROPRIATELY

The distance between stops is of key concern to many transit agencies. More closely spaced stops provide customers with more convenient access as they are likely to experience a shorter walk to the nearest bus stop. However, transit stops are also the major reason that transit service is slower than automobile trips, since each additional stop with activity requires the bus to decelerate, come a complete stop, load and unload riders, and then accelerate and re-merge into traffic. Since most riders want service that balances convenience and speed, the number and location of stops is a key component of determining that balance.

SEAT currently operates as a "flag stop" system, whereby riders stand and wait along a route and flag down a bus as it comes by. However, SEAT is currently exploring the possibility of establishing fixed stops, to make service more predictable for riders, along with the opportunity to focus passenger information and amenities at key locations. As SEAT develops a plan for establishing fixed stops, it should look to guidelines on stop spacing to ensure a balance between convenient access to stops and efficient operation of transit service.

SEAT provides different types of transit services that are tailored toward serving different types of trips and needs. In general, services that emphasize speed (e.g. Key Routes or Regional Connector routes) should have fewer stops, while services that emphasize accessibility should have more frequent stops.

The minimum stop spacing (or maximum stops per mile) is shown in Table 1. Where multiple routes operate in the same corridor, the standard for the higher service type applies. Exceptions to these guidelines should only be made in locations where walking conditions are particularly dangerous, significant topographical challenges impede pedestrian access, and factors compromise safe bus operations and dwelling.

TABLE 1 | BUS STOP SPACING GUIDELINES

	KEY ROUTE	REGIONAL CONNECTOR	LOCAL ROUTE	COMMUNITY ROUTE	SPECIAL
Minimum Stop Spacing (feet)					
Moderate to High Density Areas	900	900	660	660	n/a
Low Density Areas	1,300	1,100	1,100	1,100	n/a
Maximum Stops per Mile					
Moderate to High Density Areas	6	6	8	8	n/a
Low Density Areas	4	5	5	5	n/a

Notes: Moderate to high density = greater than or equal to 4,000 persons per square mile; low density = less than 4,000 persons per square mile

SERVICE DESIGN SHOULD MAXIMIZE SERVICE

Service design can significantly impact schedule efficiency. Service should be designed to maximize in-service time and minimize out-of-service time. In other words, the length of the route and the time it takes to make each trip impacts how long of a layover is required at each end and how many buses are needed to provide the service. Often, it may be more efficient to extend a route to pick up a few more passengers and limit the amount of layover time.

4 SERVICE LEVEL GUIDELINES

Service level guidelines define when service should be provided and how often it should be provided. Four guidelines are used:

1. Service Coverage
2. Minimum Span of Service
3. Minimum Service Frequencies
4. Maximum Passenger Loadings

These guidelines, in combination with the productivity guidelines presented in Section 5, are used to determine appropriate service levels for each route. At a minimum, service should be provided based on the minimum span of service and minimum service frequency guidelines. Beyond that, additional service should be added to meet passenger loading guidelines, and to extend the span of service earlier in the morning and later at night if minimum productivity guidelines can be met.

On an ongoing basis, service should be added when ridership increases to levels that exceed maximum loading guidelines. Conversely, service should also be reduced when ridership falls below the minimum productivity guidelines.

SERVICE COVERAGE

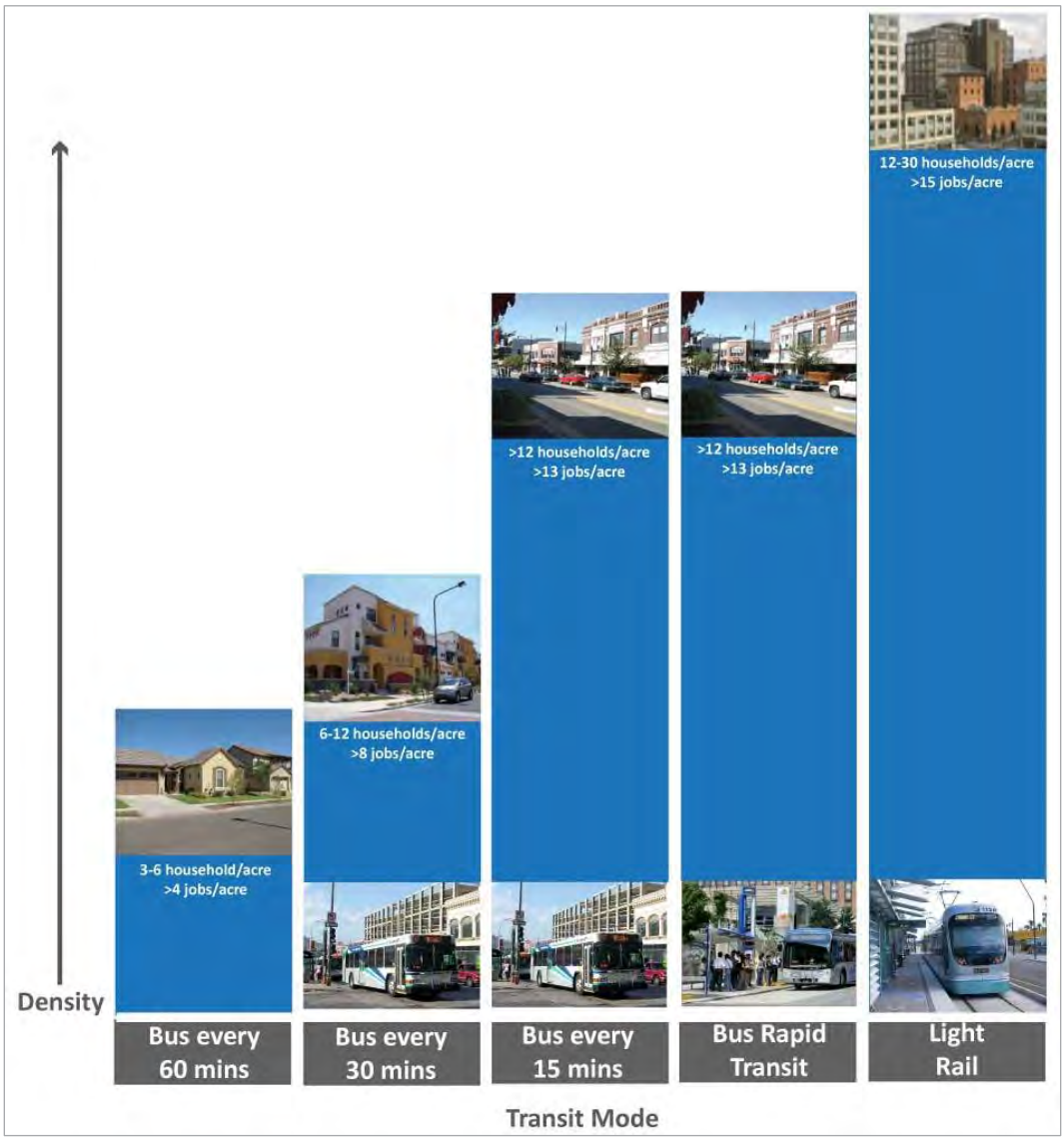
SEAT currently serves 10 member municipalities in Southeastern Connecticut: East Lyme, Griswold, Groton, Ledyard, Lisbon, Montville, New London, Norwich, Stonington, and Waterford. Although there are areas that are more urban and densely populated, including New London, Norwich, and Groton, most of the SEAT service district is characterized by low-density development or rural communities, which are difficult to serve with transit. In addition, many clusters of development or activity centers are geographically isolated, which presents a challenge for SEAT productivity as the low-density areas in between are unlikely to generate sufficient demand for productive service.

Population and employment densities are one of the strongest indicators of potential transit demand. Figure 1 on the following page provides a general guideline for where different levels of transit service may be warranted. Once densities begin to exceed 3 to 6 households per acre or 4 jobs per acre, fixed route bus services may be viable. More densely developed areas may warrant higher levels of transit service.

Population and employment density should be used to evaluate the potential for service. If densities are relatively high along a continuous corridor, or if the corridor connects major activity centers or hubs, a higher level of service may be warranted. If densities meet the minimum guidelines, but only exist in small or scattered areas, travel demand may not be sufficient to support transit. Or, a lower level of transit – such as Flex or on-demand services – may be warranted.

Other factors must also be considered when deciding whether an area can support productive transit service. These include demographic data within the corridor, such as the number of transit dependant individuals and household incomes. Other local conditions, such as the cost of parking, can increase transit demand. Note that these guidelines only apply to the evaluation of potential service; existing service should not be evaluated with these service coverage guidelines.

FIGURE 1 | TRANSIT SUPPORTIVE POPULATION AND EMPLOYMENT DENSITIES



Source: Composite data compiled by Nelson\Nygaard from various sources.

MINIMUM SPAN OF SERVICE

The number of hours per day when transit service is provided along a route, a segment of route, or between two locations plays a role in determining the availability of transit service to potential users. Transit service must be available near the time a trip needs to be made in order for transit to be a travel option. Ideally, transit service should operate according to the standard time periods specified (peak rush hours, midday, night, etc.) to minimize customer uncertainty.

Passenger needs and the transit authority's financial capacity are key considerations in setting weekday service spans, and in deciding which routes are operated on Saturdays and Sundays. Weekday routes should permit workers and students to make their morning start times, and should end late enough to provide return trips home for second shift workers. Service oriented to non-work travel can start later and end sooner. Sunday service may not be necessary on many routes.

The minimum span of service guidelines define the **minimum** period of time that different types of service should operate. Minimum span of service guidelines are presented in Table 2. Note that service can start earlier and end later if demand warrants, but the extra service would be subject to the minimum performance guidelines presented in Section 5. Also, the guidelines may not apply to some services on certain days, indicated by a "–". Service may still be provided on these days (to meet other guidelines, for example), though it would not be subject to minimum span of service guidelines.

TABLE 2 | MINIMUM SPAN OF SERVICE GUIDELINES

	KEY ROUTE	REGIONAL CONNECTOR	LOCAL ROUTE	COMMUNITY ROUTE	SPECIAL
Weekdays					
Begin	6:00 AM	7:30 AM	7:30 AM	7:00 AM	–
End	10:00 PM	5:00 PM	7:30 PM	4:30 PM	–
Saturdays					
Begin	6:00 AM	–	7:30 AM	–	–
End	10:00 PM	–	7:30 PM	–	–
Sundays					
Begin	7:00 AM	–	8:00 AM	–	–
End	4:00 PM	–	3:30 PM	–	–

Notes: The beginning span of service refers to the departure of the first trip, and the ending span of service refers to the departure time of the last trip.

MINIMUM SERVICE FREQUENCIES

Service frequency (the time interval between two vehicles traveling in the same direction on the same route) has a major influence on transit ridership; high frequency service is often considered a key characteristic for attractive service. At the same time, frequency has a significant impact on operating costs, and service requirements increase exponentially with improvements in service frequency.

Because of the expense of high frequency service, transit service frequency is normally based upon existing or potential demand. This often translates into variations in service frequency throughout the day, with higher frequency in peak periods, and less frequent service outside of the peak.

In general, frequencies are established to provide enough vehicles past the maximum load point(s) on a route to accommodate the passenger volume and stay within recommended loading standards. Minimum service frequency guidelines are presented in Table 3. Note that when a corridor is served by multiple routes, effective service frequencies in the corridor would be more frequent than those for individual routes. For certain routes serving outlying parts of the service area, service areas may be reduced to maintain satisfactory farebox recovery ratios. As with all standards, this service frequency matrix should be considered a guide, not an absolute measure.

TABLE 3 | MINIMUM SERVICE FREQUENCY GUIDELINES (MINUTES)

	KEY ROUTE	REGIONAL CONNECTOR	LOCAL ROUTE	COMMUNITY ROUTE	SPECIAL
Weekdays					
Day	60	120	60	120	—
Night	120	120	60	120	—
Saturdays					
All Day	120	120	120	120	—
Sundays					
All Day	120	120	120	120	—

Note: "—" indicates that the guideline does not apply. Also, the guidelines apply to services that are provided, and do not imply that all services will be provided at all times.

Clock-face service intervals (e.g. every 10, 12, 15, 20, 30 or 60 minutes) are easier for passengers to remember and can help facilitate better transfer connections between routes. Whenever possible, frequencies should be set at regular clock-face intervals. However, there are two key exceptions:

- Where individual trips must be adjusted away from clock-face intervals to meet shift times, work times, transfer connections, or other special circumstances;
- Where the desired frequency of service causes round trip recovery time to exceed 20% of the total round trip vehicle time, leading to inefficient service.

VEHICLE LOADING

SEAT will design its services to keep the number of passengers on its vehicles at a comfortable level, always within the limits of safety. In peak periods, this means that some passengers may be expected to stand for part of the trip. In off-peak periods and for service that operates for long distances, service will be designed to try to provide a seat to all customers.

Two different techniques are used to keep passenger loads within acceptable levels. The first is to match vehicle types with ridership levels, and to use larger vehicles on higher ridership routes. The second method is to provide more frequent service, with service frequencies set to keep passenger loads within the limits presented in Table 4.

The vehicle load standard is calculated on the basis of an average for the both the peak and off-peak periods, at the busiest point on the route. For instance, if a service operates at 15-minute frequency, then 4 buses would pass the busiest point in an hour. The average number of passengers for these 4 buses must fall within the service standards, even though any one bus may be more crowded than the average. If the standard is exceeded for the average calculation, SEAT will consider more frequent service or larger vehicles to improve the situation.

TABLE 4 | AVERAGE VEHICLE LOADING MAXIMUMS

	KEY ROUTE	REGIONAL CONNECTOR	LOCAL ROUTE	COMMUNITY ROUTE	SPECIAL
Average Maximum Passenger Loading (as a percentage of seating capacity)	120%	100%	120%	100%	100%

Note: Maximums are averages over one-hour periods; individual trips may exceed averages.

TABLE 5 | VEHICLE CAPACITIES

	60' ARTICULATED BUS	40' BUS	35' BUS
100% of Seating Capacity	55	36	28
120% of Seating Capacity	66	43	34

Note: SEAT does not currently operate articulated vehicles, but may do so in the future.

5 PERFORMANCE

SEAT must use its resources effectively and all routes should achieve a minimum level of productivity. The two primary guidelines to assess performance:

1. Productivity in terms of "Passengers per Revenue Vehicle Hour".
2. Cost-Effectiveness, in terms of Farebox Return, which is the percentage of operating expenses recouped by farebox revenues.

PASSENGERS PER REVENUE HOUR

With limited exceptions, all service should attract a minimum level of ridership. This minimum level of ridership is expressed in terms of Passengers per Revenue Service Hour, or in simpler terms, the average number of passengers that a bus should serve for each hour it is in service. These minimum productivity levels are presented in Table 6.

TABLE 6 | MINIMUM PRODUCTIVITY LEVELS (PASSENGERS PER REVENUE VEHICLE HOUR)

	KEY ROUTE	REGIONAL CONNECTOR	LOCAL ROUTE	COMMUNITY ROUTE	SPECIAL
Minimum Passengers per Revenue Vehicle Hour					
Weekday	20	10	20	10	–
Saturday	15	10	15	10	–
Sunday	10	10	15	10	–

Note: "—" indicates that the standard does not apply.

FAREBOX RECOVERY

The second performance measure is farebox recovery, which is the percentage of operating expenses recouped by farebox revenues. Minimum farebox recovery percentages are shown in Table 7.

TABLE 7 | MINIMUM FAREBOX RECOVERY

	KEY ROUTE	REGIONAL CONNECTOR	LOCAL ROUTE	COMMUNITY ROUTE	SPECIAL
Minimum Farebox Recovery					
Weekday	20%	20%	20%	20%	n/a
Saturday	15%	15%	15%	15%	n/a
Sunday	15%	15%	15%	15%	n/a

APPLICATION OF PERFORMANCE GUIDELINES

In cases where routes do not meet minimum performance guidelines, changes should be made to improve route performance. These changes can include a variety of measures, including reconfiguring the route alignment to attract more passengers, targeted marketing, eliminating particularly unproductive segments, and reducing service levels. If no changes can be identified that improve performance, steps

may be taken to discontinue the route unless it serves a demonstrable critical need that is not served by other routes or services (including paratransit service).

In cases where service expansion is considered, ridership and productivity estimates should be developed that indicate that there is a reasonable certainty that the new service will meet the performance guidelines within 12 months of implementation.

6 SEAT ROUTE CLASSIFICATIONS

KEY ROUTES

600 Norwich – New London

REGIONAL CONNECTOR ROUTES

980 Norwich – New London Express
981 New London – Foxwoods Express
982 Norwich – Foxwoods Express*

SPECIAL SERVICES

625 Mystic Shuttle*

LOCAL ROUTES

610 Mohegan Sun – Hamilton
611 West Main – Occum
613 Jewett City
620 Broad Street – Groton
621 Ocean Beach – Groton/Pequot Medical Center
622 New London

COMMUNITY ROUTES

601 Norwich – Groton
612 Industrial Park
623 Waterford
624 Niantic
626 Stonington
627 Groton (Avery Point – U.S. Naval Base)*

** Included in the System Expansion Plan only*

APPENDIX E

Title VI Environmental Justice Analysis

SEAT BUS STUDY

TITLE VI ANALYSIS

October 2015

SCCOG SEAT CONNECTICUT DEPARTMENT OF TRANSPORTATION

NELSON NYGAARD ASG PLANNING

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INTRODUCTION

Title VI of the Civil Rights Act of 1964 ensures that "no person in the United States shall, on the basis of race, color, or national origin, be excluded from participation in, be denied the benefits of, or be subjected to discrimination under any program or activity receiving Federal financial assistance." The Southeast Area Transit District (SEAT) has committed to the Federal Transit Administration (FTA) Title VI objectives set forth in Circular 4702.1B ensuring that FTA-assisted benefits and related services are made available and are equitably distributed without regard to race, color, or national origin.

The SEAT Bus Study was conducted to identify cost neutral service improvements that would better serve existing riders and improve the overall efficiency of SEAT service, as well as attract more riders to use SEAT. Three service plan options – two cost neutral plans and one plan for system expansion – are presented for consideration in the final report of this study. The changes recommended under the three plans largely consist of service design changes, including modifications to existing routes to make operation faster and more direct, reduce the need for transfers, and improve service reliability. Improvements also consist of improvements to service span and frequency, with the scale of improvement varying by plan. This Title VI analysis assesses each plan and identifies any potential disparate impacts to minority and low-income populations in the SEAT service area.

For each plan, three areas identified: those areas where service would be improved, those areas where service would be reduced, and areas where there would no longer be service. To measure potential disparate impacts of the plans, the composition of each of these areas was measured and compared to the composition of the entire SEAT service area to determine whether areas losing service had disproportionately high minority or low-income populations, or whether areas with improved service had disproportionately low minority or low-income populations. This document presents the analysis of each of the three plans (Cost Neutral Plan A, Cost Neutral Plan B, and System Expansion Plan C) and concludes with a summary of the findings.

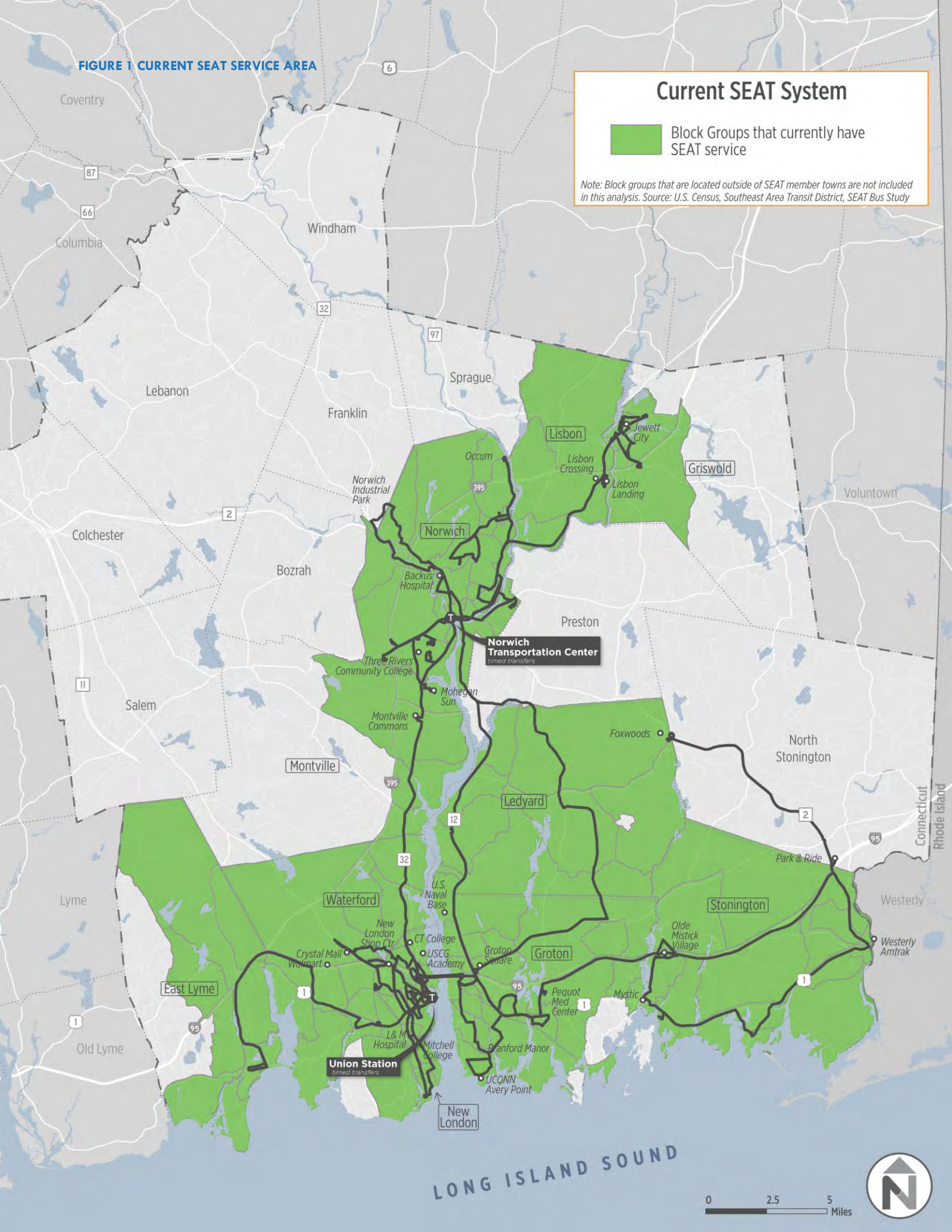
TITLE VI ANALYSIS OF SEAT IMPROVEMENT PLANS

This analysis measured the impacts of the recommended SEAT Improvement Plans on both minority and low-income populations within the current SEAT service area. "Minority" individuals were counted as all individuals who are not White non-Hispanic. Within the SEAT service area, 27.3% of the population can be considered minority under this assumption. "Low-income" individuals are counted as those who reside in households where the household income is equal to or less than 80% of the area median income, as defined in the Census 2010 Low and Moderate Income Summary Data (LMISD) provided by the U.S. Department of Housing and Urban Development (HUD). Within the SEAT service area, 40.6% of the population is considered low-income based on this data.

For the purposes of this analysis, SEAT's "service area" is defined as census block groups that are within ¼ mile of SEAT routes. Block groups were used since they are the smallest geographic unit for which data was available for both the minority and low-income population data. Many block groups are relatively large compared to the service area, especially outside of the more densely populated urban areas, and extend outside of this ¼ mile buffer; therefore, block groups that are even partially within ¼ mile of a SEAT route are included as part of the service area in this analysis. A map of the SEAT service area with existing service is presented in Figure 1.

Each of the three potential SEAT Improvement Plans – Cost Neutral Plan A, Cost Neutral Plan B, and System Expansion Plan C – were analyzed with regard to how levels of service would change under each plan, and whether these changes would have a disparate impact on minority and low-income populations in the SEAT service area. Block groups were identified as having service improved, reduced, or eliminated under each plan, and the impacts for each category are summarized for each of the three plans. Improvements and reductions in service area defined as either increased or reduced frequencies, service spans, and days of service. Block groups where service was unchanged are not specifically highlighted in this analysis.

FIGURE 1 CURRENT SEAT SERVICE AREA



COST NEUTRAL PLAN A

The service area for SEAT under Cost Neutral Plan A is shown in Figure 2. Under this plan, the composition of the population changes slightly, with minor increases in the share of population by both minority and low-income residents (see Table 1). Figures 3 through 5 present the block groups that would have improved, reduced, and eliminated service, respectively.

As shown in Figure 3, most block groups would have better service than they do today. Across all block groups that would have improved service under Plan A, minority residents account for 36.3% of the population, while low-income residents represent 50.8% of the population. Both of these figures are above the current SEAT service area average. Among block groups that would have less service under the plan, minority residents represent 19.7% of the population, less than the current SEAT average. This is also true for low-income residents, which represent 29.4% of the population in block groups with reduced service, compared to the current SEAT average of 40.6%. Block groups that would no longer have service under Plan A have even lower shares of minority and low-income populations, 13.4% minority residents and 26.2% low-income residents.

TABLE 1 COMPOSITION OF SEAT SERVICE AREA, PLAN A VERSUS TODAY

	% MINORITY	% LOW INCOME
Composition of SEAT service area under Plan A	29.9%	43.5%
Composition of SEAT service area today	27.3%	40.6%
Areas with service improved	36.3%	50.8%
Areas with service reduced	19.7%	29.4%
Areas with service eliminated	13.4%	26.2%

➲ No Disparate Impact on Minority or Low-Income Populations in the SEAT Service Area

FIGURE 2 COST NEUTRAL PLAN A SERVICE AREA

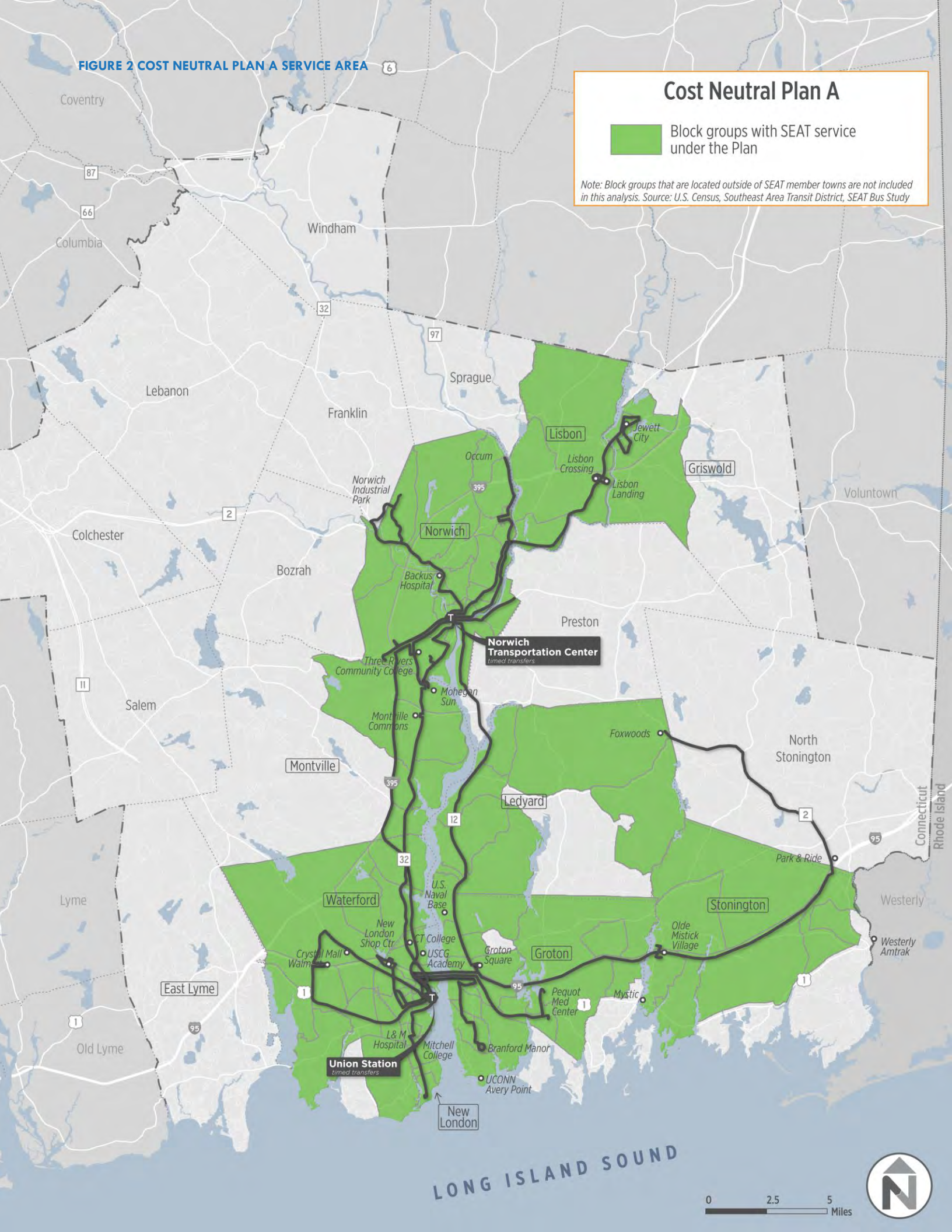


FIGURE 3 COST NEUTRAL PLAN A: BLOCK GROUPS WITH IMPROVED SERVICE

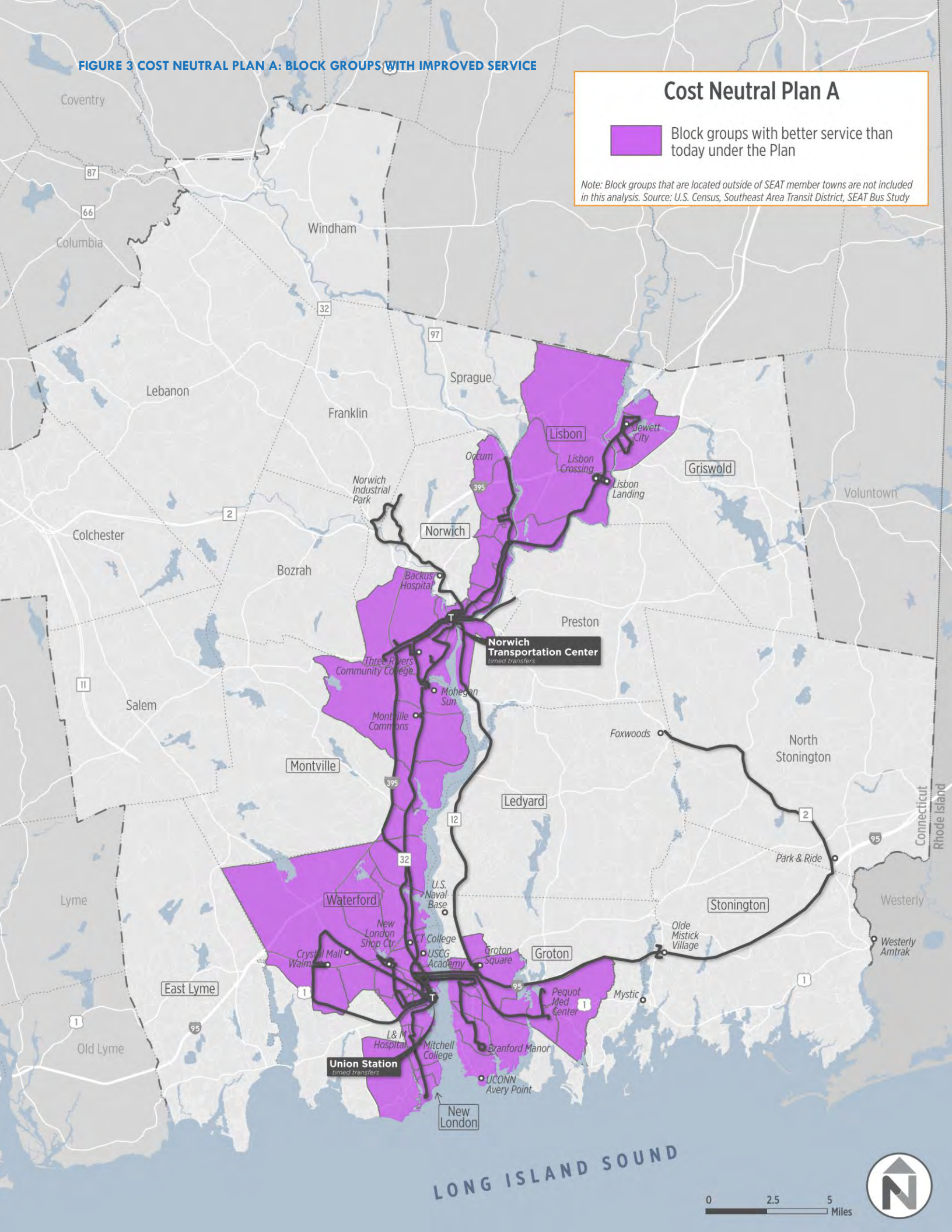


FIGURE 4 COST NEUTRAL PLAN A: BLOCK GROUPS WITH REDUCED SERVICE

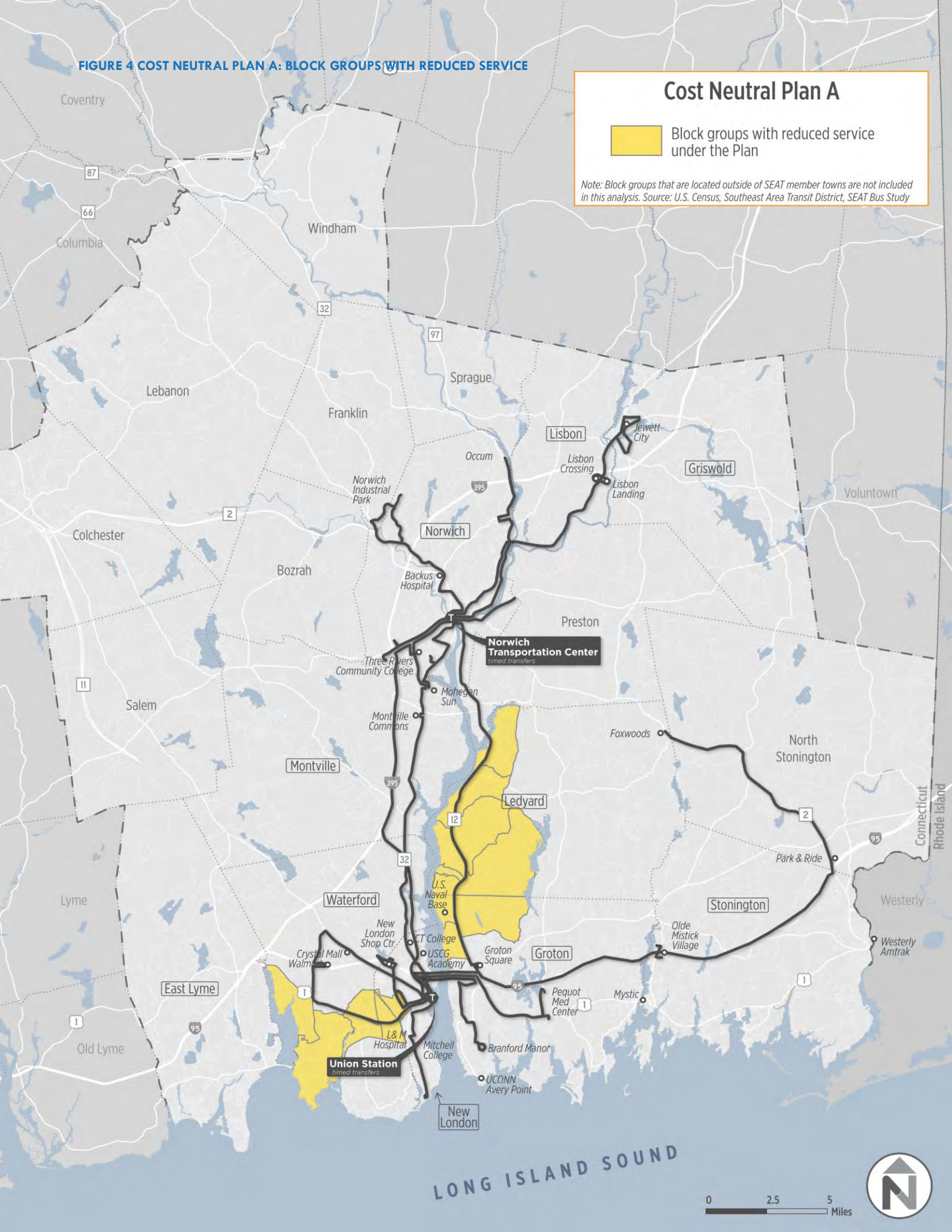
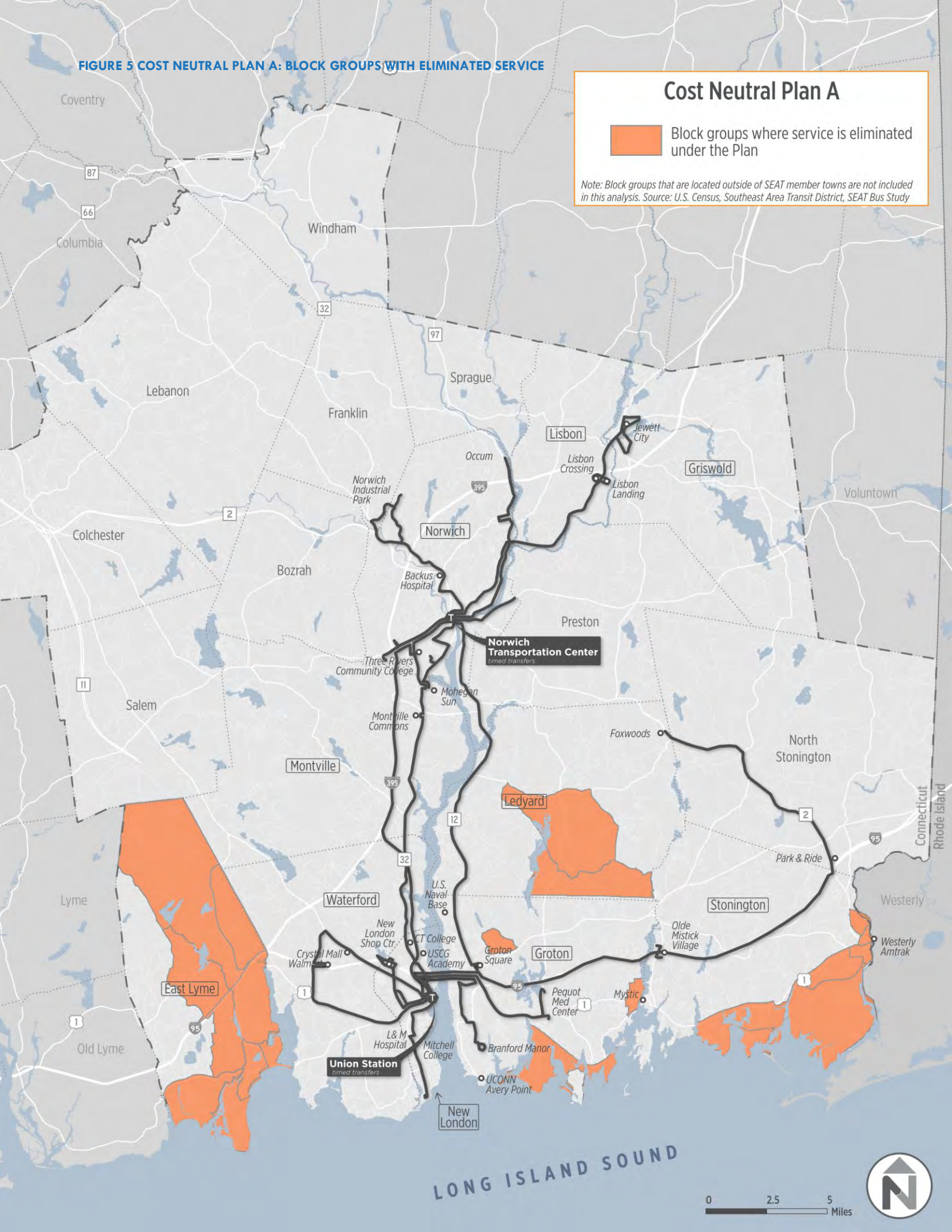


FIGURE 5 COST NEUTRAL PLAN A: BLOCK GROUPS WITH ELIMINATED SERVICE



COST NEUTRAL PLAN B

The service area for SEAT under Cost Neutral Plan B is shown in Figure 6. Under this plan, the composition of the population changes slightly, with minor increases in the share of population by both minority and low-income residents (see Table 2). Block groups within the SEAT service area that would have improved, reduced, or eliminated service are presented in Figures 7, 8, and 9, respectively.

As is the case under Plan A, the areas that would have improved service under Plan B have minority and low-income populations well above the current SEAT average: 36.1% of the population with better service is minority and 51.8% of the population is low-income. Areas that would have reduced service have a smaller share of minority and low-income residents when compared to SEAT's current service area. Among these areas, 16.4% of the population consists of minority residents, and 23.6% of the population resides in low-income households. Similarly, the areas where service would be eliminated have lower than average shares of minority and low-income population as compared to the current service area.

TABLE 2 COMPOSITION OF SEAT SERVICE AREA, PLAN B VERSUS TODAY

	% MINORITY	% LOW INCOME
Composition of SEAT service area under Plan B	28.2%	41.7%
Composition of SEAT service area today	27.3%	40.6%
Areas with service improved	36.1%	51.8%
Areas with service reduced	16.4%	23.6%
Areas with service eliminated	11.7%	24.0%

➲ No Disparate Impact on Minority or Low-Income Populations in the SEAT Service Area

FIGURE 6 COST NEUTRAL PLAN B SERVICE AREA

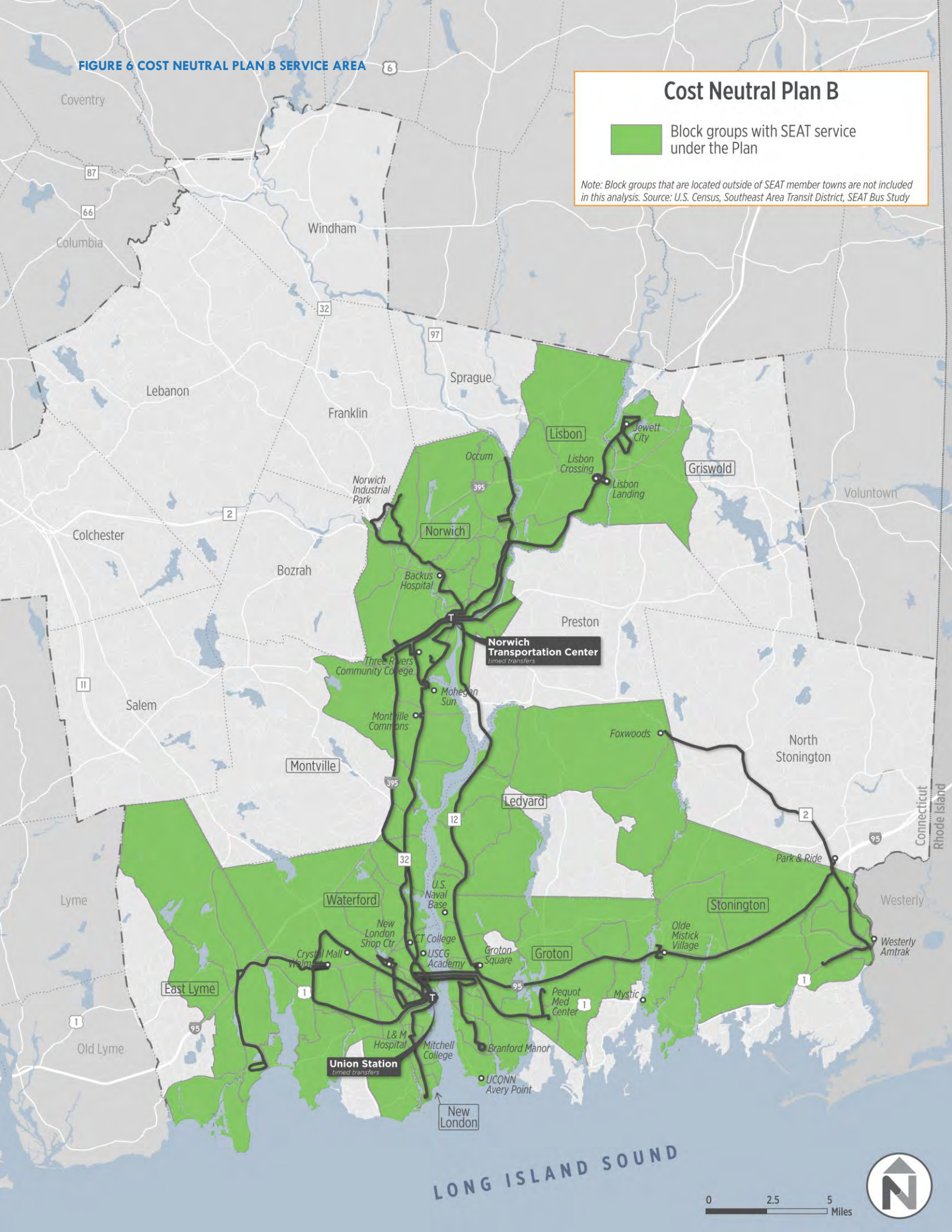


FIGURE 7 COST NEUTRAL PLAN B: BLOCK GROUPS WITH IMPROVED SERVICE

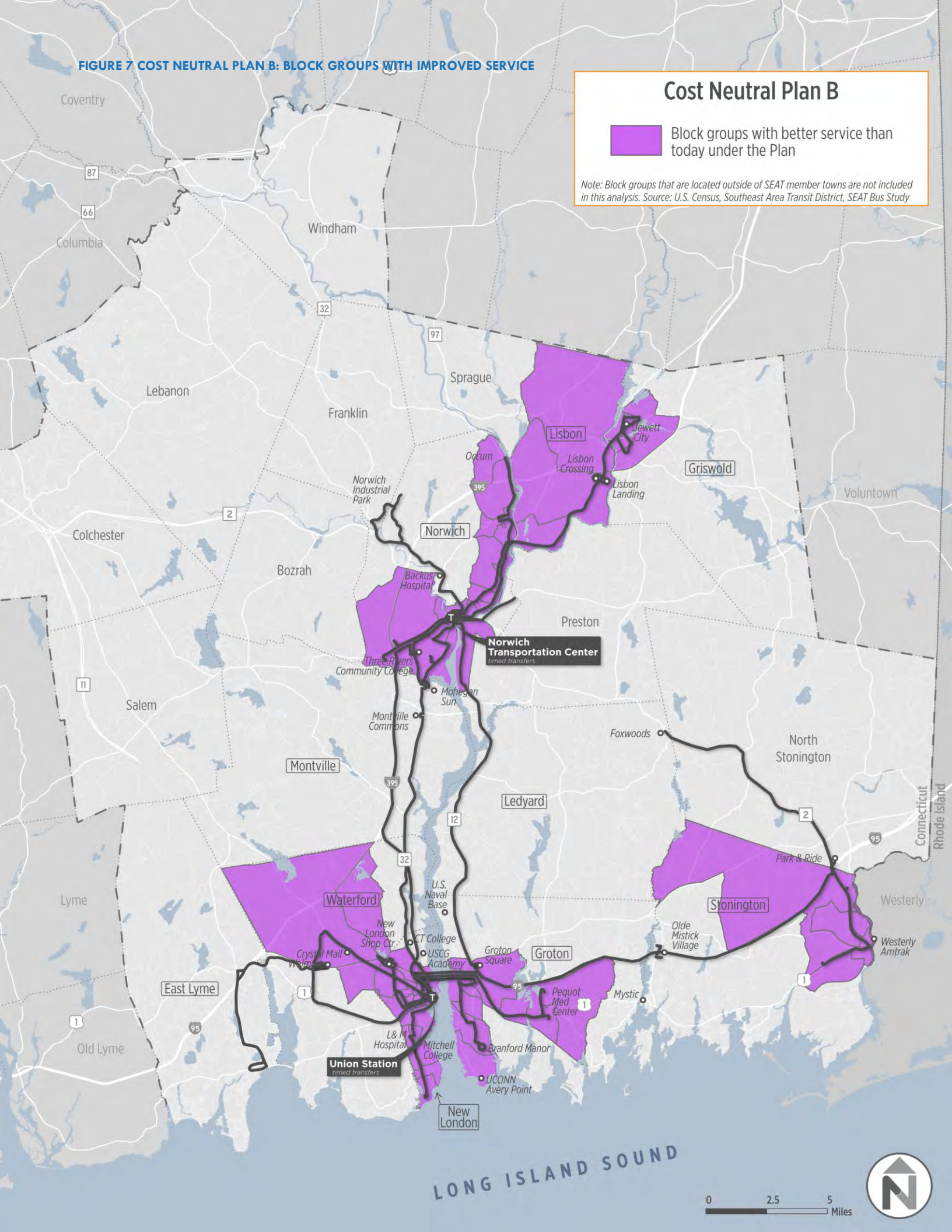


FIGURE 8 COST NEUTRAL PLAN B: BLOCK GROUPS WITH REDUCED SERVICE

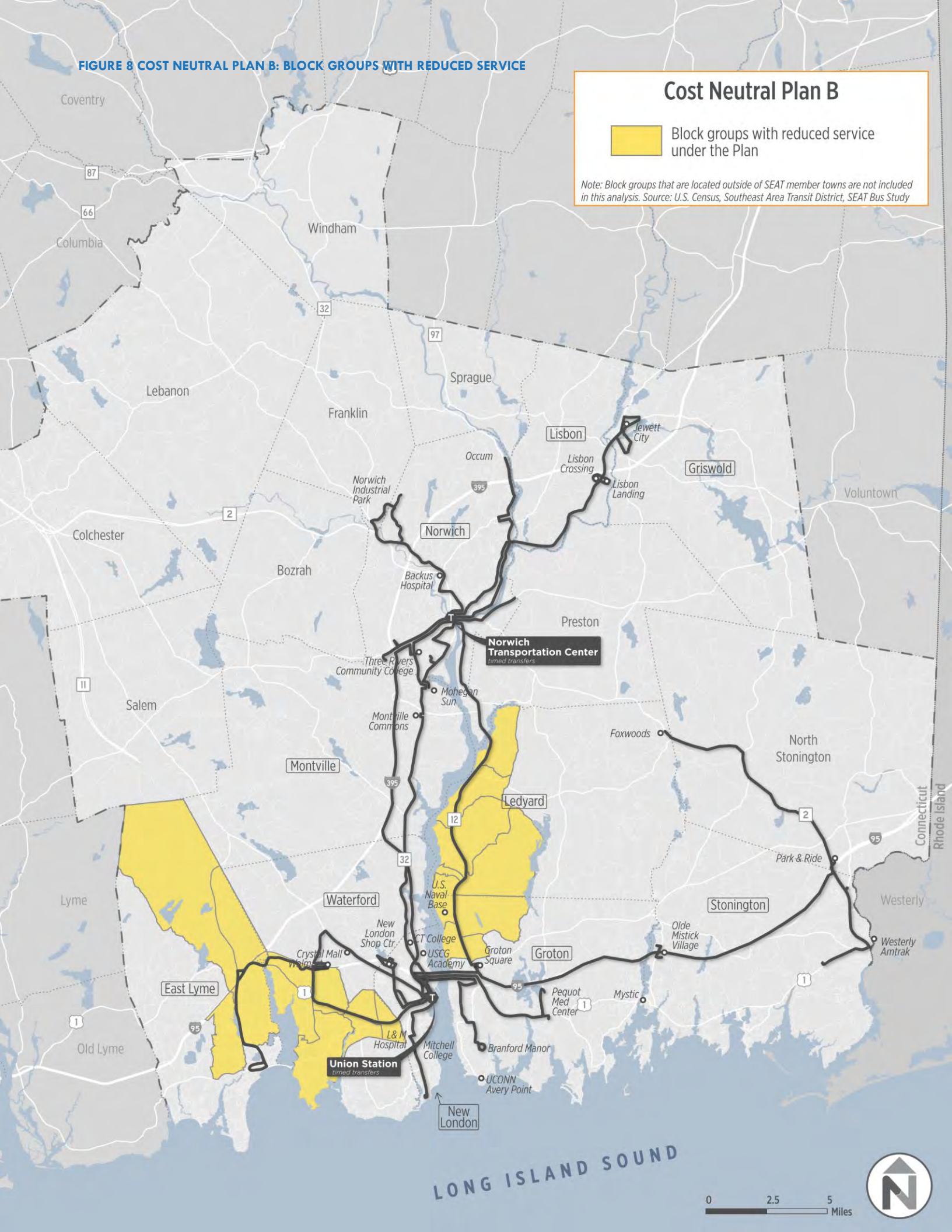
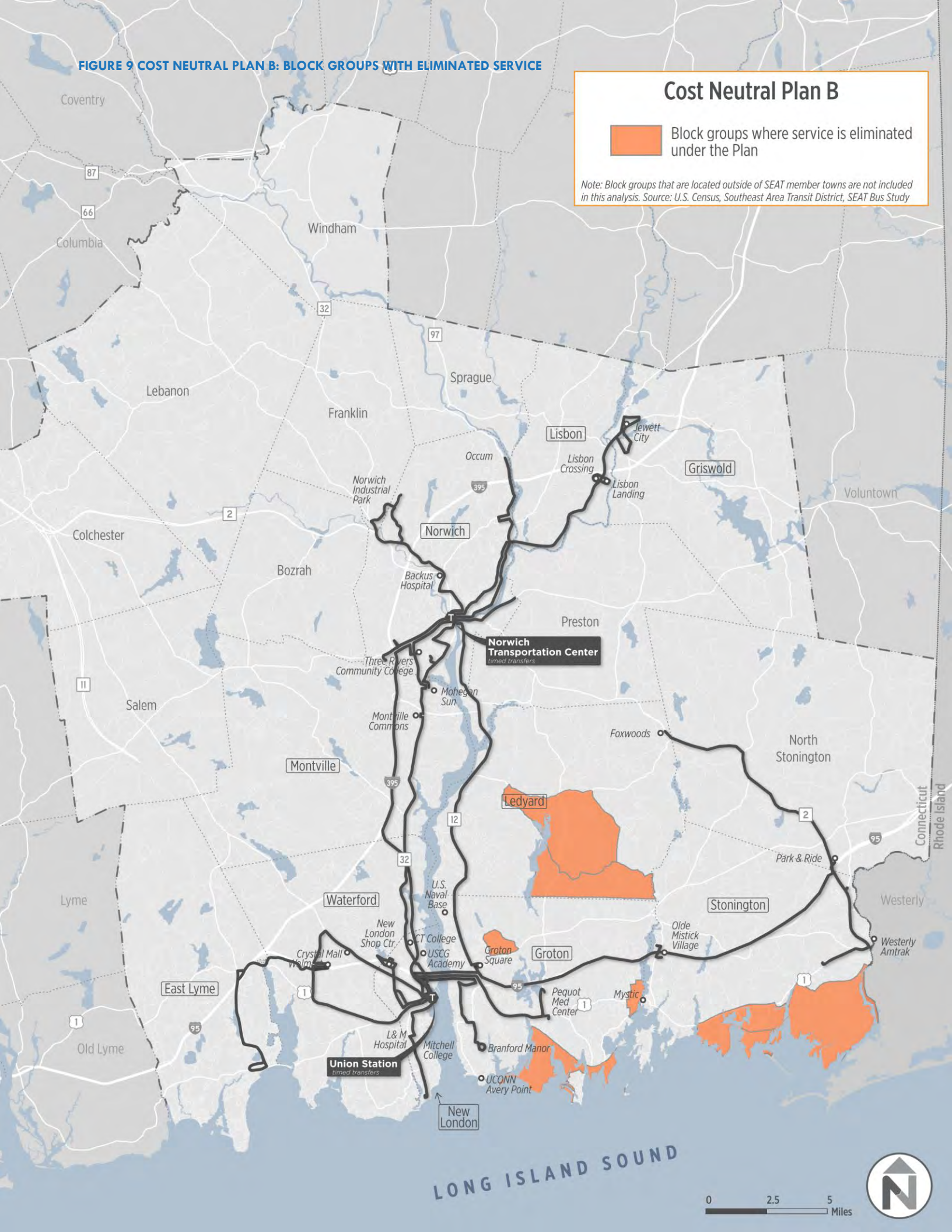


FIGURE 9 COST NEUTRAL PLAN B: BLOCK GROUPS WITH ELIMINATED SERVICE



SYSTEM EXPANSION PLAN C

The service area for SEAT under Cost Neutral Plan C is shown in Figure 10. As is the case under Plan A and Plan B, the population share of minority and low-income residents changes only slightly (see Table 3). Figures 11 through 13 present the block groups that would have improved, reduced, and eliminated service, respectively.

As shown in Figure 11, all but a few block groups would have better service than they do today. Across all block groups that would have improved service under Plan C, minority residents account for 31.0% of the population, while low-income residents represent 45.6% of the population. Both of these figures are above the current SEAT service area average, but are closer to the current average than either Plan A or Plan B. This is due to the fact that, assuming increased funding levels under this plan, levels of service would be significantly expanded and service improvements could be applied to a much larger share of SEAT's service area, encompassing more block groups with relatively low minority and low-income populations.

Among block groups that would have less service under the plan, minority residents represent 16.9% of the population, less than the current SEAT average and a lower share than under both Plan A and Plan B. This is also true for low-income residents, which represent 10.3% of the population in block groups with reduced service, compared to the current SEAT average of 40.6%. Block groups that would no longer have service under Plan C are comprised of 12.1% minority residents and 24.5% low-income residents, well below the service area average.

TABLE 3 COMPOSITION OF SEAT SERVICE AREA, PLAN C VERSUS TODAY

	% MINORITY	% LOW INCOME
Composition of SEAT service area under Plan B	28.1%	41.2%
Composition of SEAT service area today	27.3%	40.6%
Areas with service improved	31.0%	45.6%
Areas with service reduced	16.9%	10.3%
Areas with service eliminated	12.1%	24.5%

➲ No Disparate Impact on Minority or Low-Income Populations in the SEAT Service Area

FIGURE 10 SYSTEM EXPANSION PLAN C SERVICE AREA

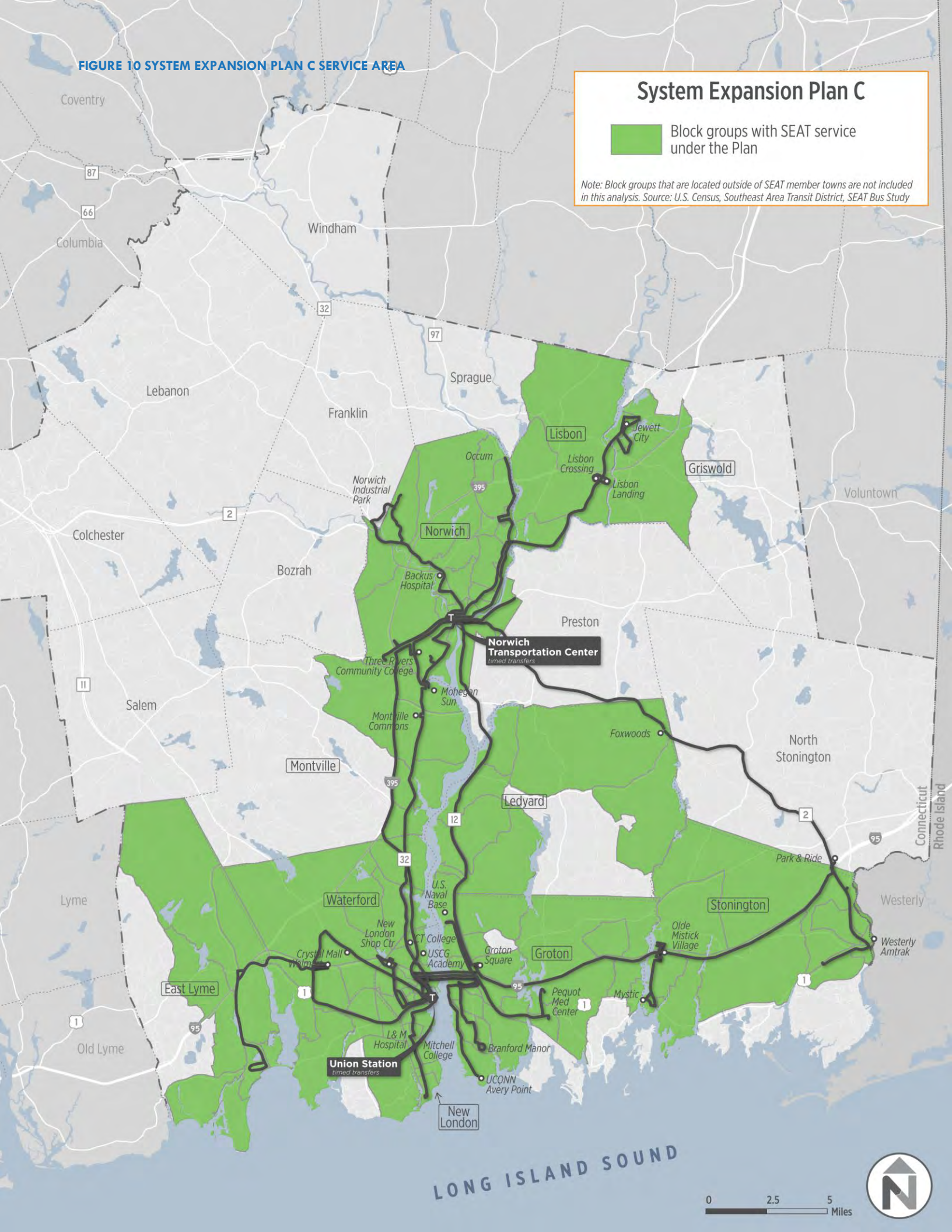


FIGURE 11 SYSTEM EXPANSION PLAN C: BLOCK GROUPS WITH IMPROVED SERVICE

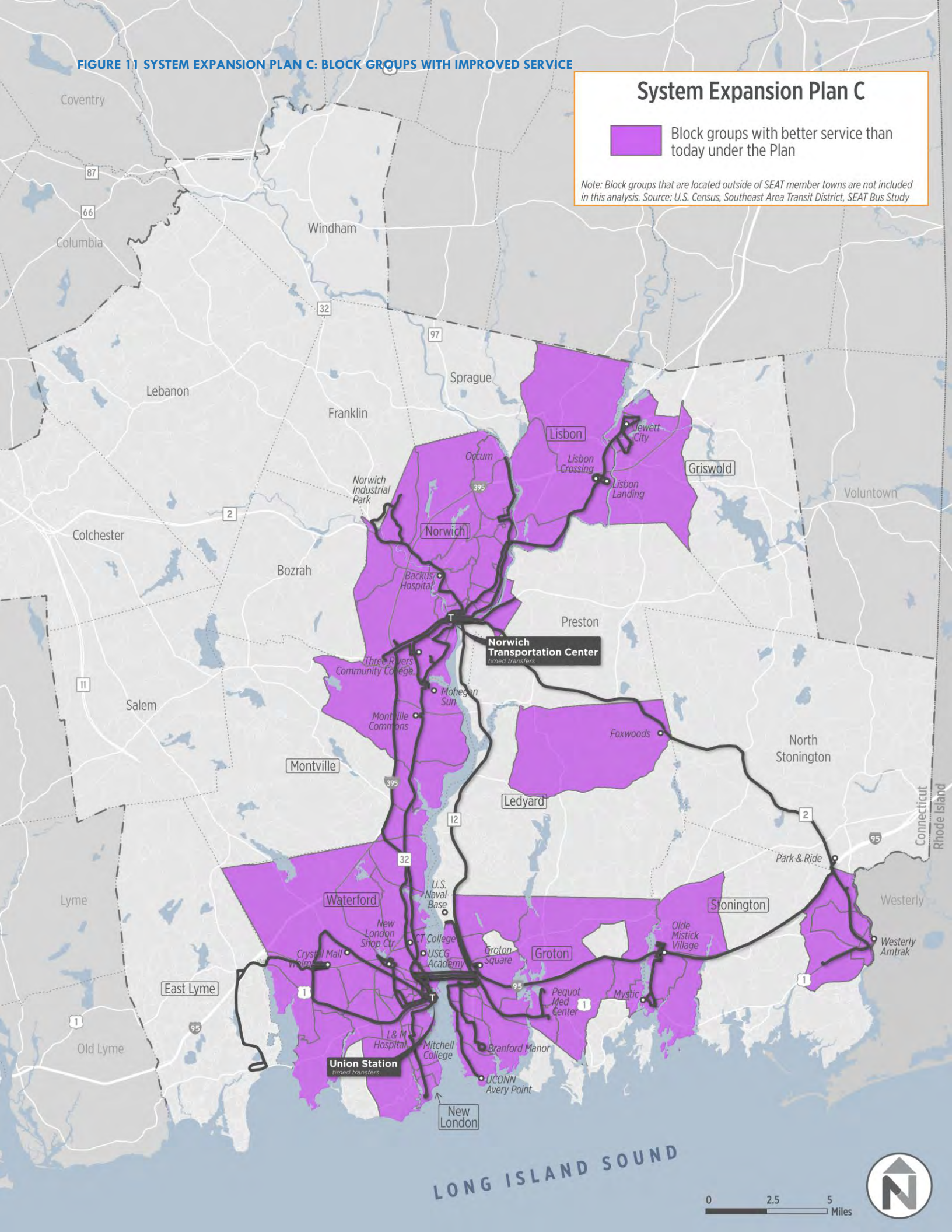


FIGURE 12 SYSTEM EXPANSION PLAN C: BLOCK GROUPS WITH REDUCED SERVICE

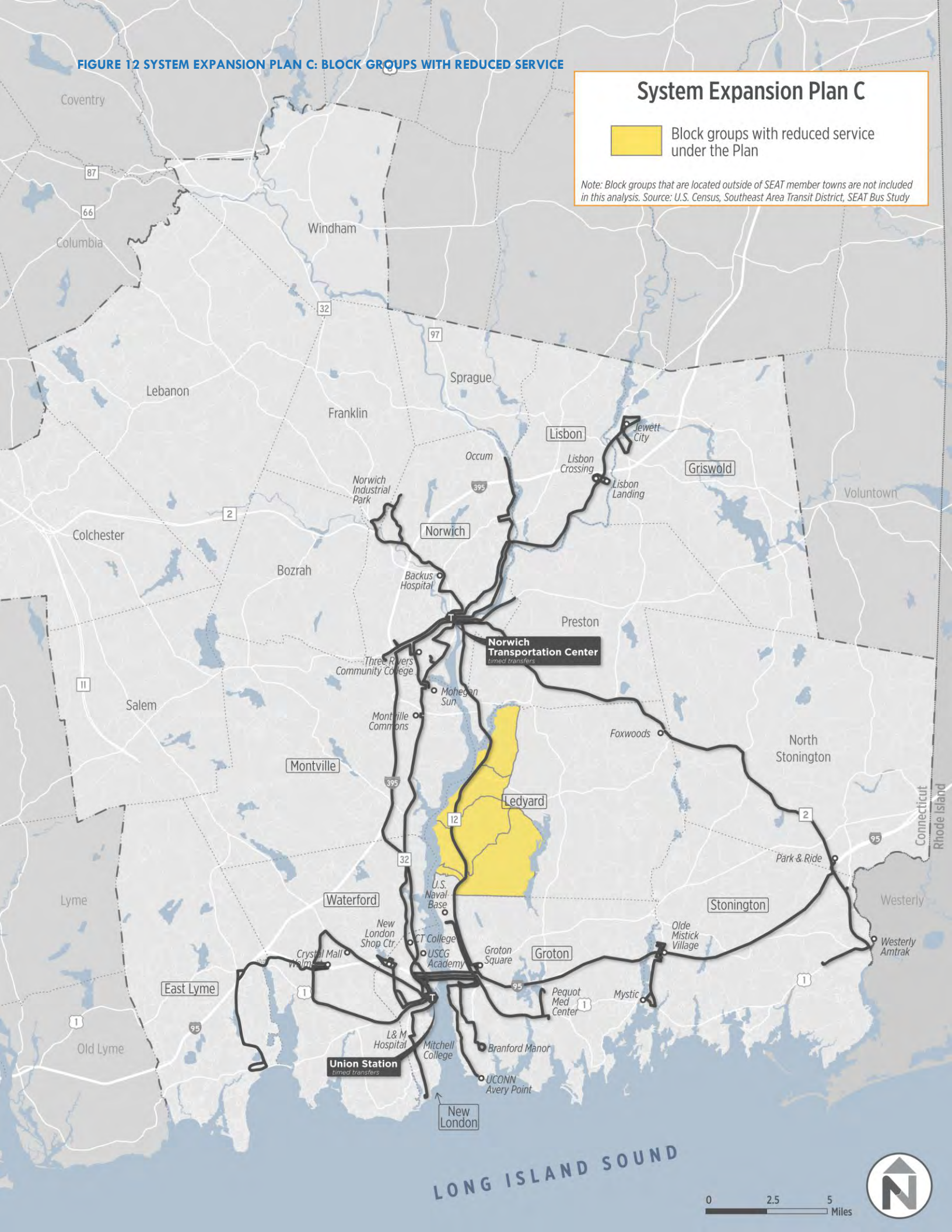
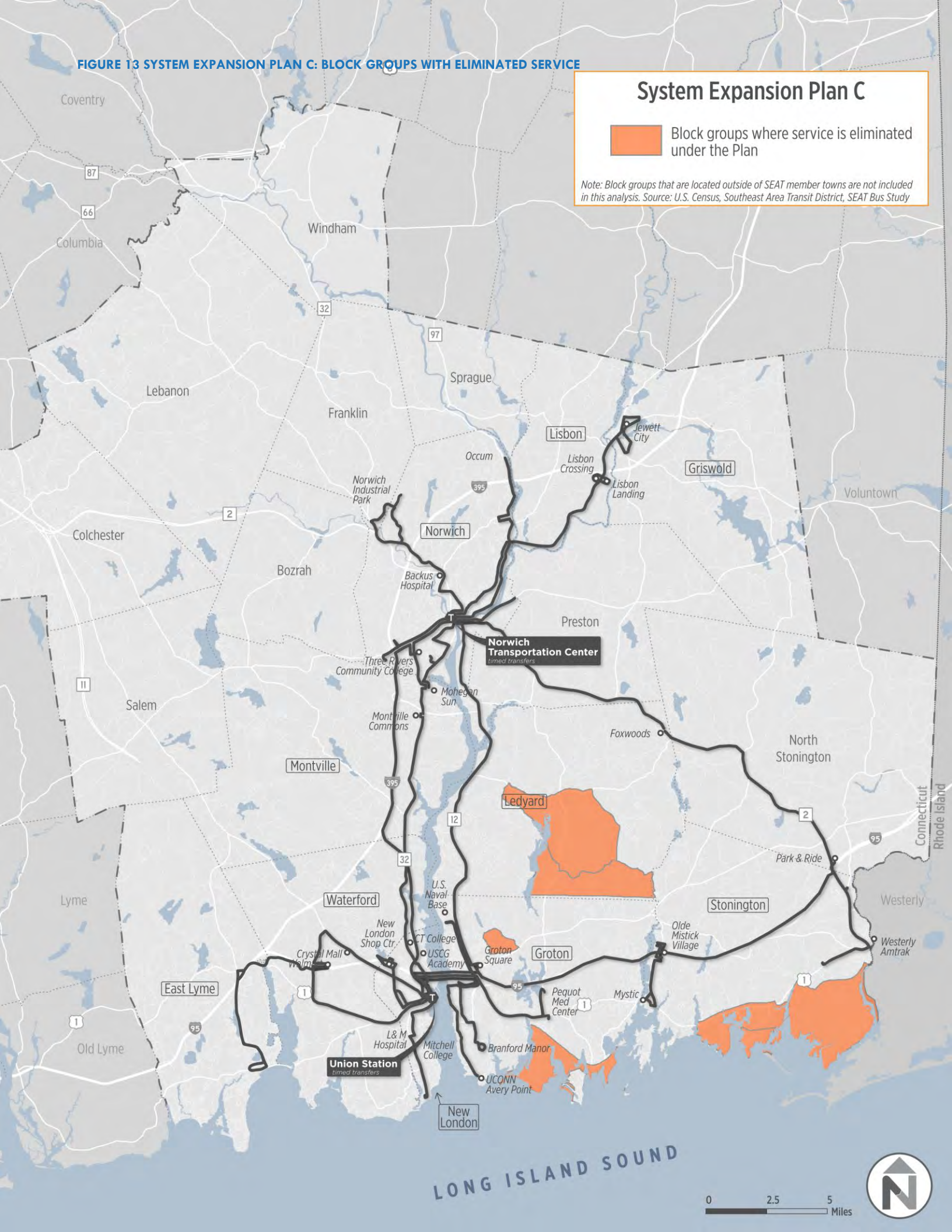


FIGURE 13 SYSTEM EXPANSION PLAN C: BLOCK GROUPS WITH ELIMINATED SERVICE



SUMMARY OF FINDINGS

This analysis evaluated the three potential SEAT Improvement Plans presented in the final report of the SEAT Bus Study, to determine whether any of the plans would result in disparate service impacts to minority or low-income residents. Based on this analysis, most block groups in the SEAT service area would see improved service under all three plans, and the areas that would have improved service have average shares of minority and low-income populations that exceed the current SEAT average. Among areas that would have reduced or eliminated service, the average shares of both minority and low-income populations are well below the SEAT averages under all three plans. Table 4 summarizes the findings of this analysis.

TABLE 4 SUMMARY OF IMPACTS ON MINORITY AND LOW-INCOME POPULATIONS UNDER SEAT IMPROVEMENT PLANS

	% MINORITY	DISPARATE IMPACT ON MINORITY POPULATIONS?	% LOW-INCOME	DISPARATE IMPACT ON LOW-INCOME POPULATIONS?
SEAT service area today	**27.3%**		**40.6%**	
COST NEUTRAL PLAN A				
Areas with service improved	36.3%	No	50.8%	No
Areas with service reduced	19.7%	No	29.4%	No
Areas with service eliminated	13.4%	No	26.2%	No
Disparate Impact Under Plan A?		**No Impact**		**No Impact**
COST NEUTRAL PLAN B				
Areas with service improved	36.1%	No	51.8%	No
Areas with service reduced	16.4%	No	23.6%	No
Areas with service eliminated	11.7%	No	24.0%	No
Disparate Impact Under Plan B?		**No Impact**		**No Impact**
SYSTEM EXPANSION PLAN C				
Areas with service improved	31.0%	No	45.6%	No
Areas with service reduced	16.9%	No	10.3%	No
Areas with service eliminated	12.1%	No	24.5%	No
Disparate Impact Under Plan C?		**No Impact**		**No Impact**

Based on this analysis, there is no finding of disparate impact on either minority or low-income populations in the SEAT service area under Cost Neutral Plan A, Cost Neutral Plan B, or System Expansion Plan C.

APPENDIX F

Regional Human Services - Public Transit Gap Analysis

SEAT BUS STUDY

SCCOG REGIONAL HUMAN SERVICES - PUBLIC TRANSIT GAP ANALYSIS

September 2015

SCCOG SEAT CONNECTICUT DEPARTMENT OF TRANSPORTATION

NELSON NYGAARD ASG PLANNING

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1 INTRODUCTION

This analysis provides an overview of the transportation gaps and needs in the study area and recommends solutions to address the unmet needs of transit dependent individuals. Part of the larger SEAT Comprehensive Operations Analysis, the Regional Human Services - Public Transit Gap Analysis discusses the existing public transportation, senior transportation, and human service transportation services available in the study area in conjunction with locations of the target populations and major destinations. Mapping these services allows the Study Team to develop a comprehensive picture of the existing transportation services to determine whether they accommodate the needs of the target populations. The findings are categorized into the following:

- Spatial Limitations; to identify geographic gaps in service
- Temporal Limitations; to identify gaps in service on specific days and times
- Client Eligibility Limitations; to identify certain populations that are not served
- Trip Purpose Limitations; to identify certain type types that are not served

After identifying service gaps and needs in the study area, the Study Team developed several mobility management solutions to increase coordination and expand service to transit dependent individuals. These solutions provide low-cost options for a lead agency to implement, noting that the lead agency can be different for different mobility management strategies. These strategies include:

- One-Call/One-Click Central Directory
- Flexible Travel Voucher
- Coordinated Volunteer Driver Program
- Vehicle Sharing Program

Potential lead agencies in the study area include Southeast Area Transit District (SEAT), Eastern Connecticut Transportation Consortium (ECTC), the Southeast Connecticut Council of Governments (SCCOG), another human service organization, or a partnership of one or more of these entities.

2 EXISTING SERVICES

This section describes each existing service available in the region by type, including regional transit and paratransit, senior transportation, human service transportation, and other transportation programs.

REGIONAL TRANSIT AND PARATRANSIT SERVICES

There are three public transit providers in the study area that provide fixed route, deviated fixed route, and demand-response transportation:

Southeast Area Transit District (SEAT)

SEAT serves the 10 member municipalities of Griswold, Norwich, Montville, Lisbon, East Lyme, Waterford, New London, Groton, Ledyard, and Stonington in Southeastern Connecticut. SEAT provides fixed route service and ADA Paratransit service. These SEAT member cities and towns are part of the Southeastern Connecticut Council of Governments (SCCOG), which also include the non-SEAT member municipalities of Windham, Lebanon, Franklin, Sprague, Colchester, Bozrah, Salem, Preston, and the North Stonington borough.

- Fixed route transit is provided to general public within the member communities via 15 routes.
- Paratransit services are contracted to the Eastern Connecticut Transportation Consortium (ECTC) to provide demand-response transportation for ADA eligible customers. ADA Paratransit service is provided for the ¾ mile boundary of SEAT fixed route service and follows the same service days/times as fixed route service.

The New London County Dial-A-Ride Service

New London County Dial-A-Ride is provided by ECTC and is offered to elderly (60+) and disabled residents of Bozrah, East Lyme, Griswold, Groton, Lisbon, Ledyard, New London, North Stonington, Stonington, and Waterford for ***medical transportation*** to destinations throughout the study area.

The service is provided 24 hours per day, seven days per week. Funded by Connecticut Department of Transportation (ConnDOT), each participant is limited to 24 trips per year. This program will herein be referred to as the "New London County DAR" service.

In order to participate in the New London County DAR service, municipalities must provide additional transportation services for their residents in the same funding amount as they receive for the New London County DAR service. For example: if one municipality provides $20,000 worth of local transportation, they are eligible for $20,000 of DAR service. Many municipalities provide this additional service via senior center transportation.

The Windham Region Transit District Dial-A-Ride Service

The Windham Region Transit District Dial-A-Ride service is provided to residents within the ten-town Windham Region (Ashford, Chaplin, Columbia, Coventry, Hampton, Lebanon, Mansfield, Scotland, Willington and Windham). Windham has six member towns that pay for the service, but WRTD provides service to the ten surrounding communities. Service is provided weekdays for any type of trip and is open to the public. This program will herein be referred to as the "WRTD DAR" service.

Greater Hartford Commuter Express Bus Map

The Greater Hartford Commuter Express Bus Map operated by CT Transit connects Windham and Colchester in the study area to the City of Hartford. Colchester has pick up locations at the Colchester Town Garage and Lake Hayward Park & Ride and makes a stop in Marlborough, Glastonbury, and Downtown Hartford. Windham has three pick up locations in Willimantic and makes a stop in Columbia, Andover, Bolton, and Downtown Hartford. This express service is available Monday through Friday from around 5:30 am to 8:30 am and 12:00 pm to 6:45 pm.

TABLE 1 | REGIONAL TRANSIT AND PARATRANSIT SERVICES

Service Name	Service Origins	Service Destinations	Service Days	Service hours	Client Eligibility	Trip Type
SEAT Fixed Route	SEAT Service Area	SEAT Service Area	Seven days a week	Varies	General public	Any
SEAT ADA Paratransit	¾ mile boundary along SEAT route	¾ mile boundary along SEAT route	Seven days a week	Varies	ADA paratransit eligible	Any
New London County Dial-A-Ride	Bozrah, East Lyme, Griswold, Groton, Lisbon, Ledyard, New London, Stonington, Waterford, North Stonington	SCCOG-area	Seven days a week	24 hours per day	60+ and/or disabled residents of origin communities	Medical only
Windham Region Transit District Dial-A-Ride	Ashford, Chaplin, Columbia, Coventry, Hampton, Lebanon*, Mansfield, Scotland, Willington, Windham*	Ashford, Chaplin, Columbia, Coventry, Hampton, Lebanon*, Mansfield, Scotland, Willington, Windham*	Monday-Friday	8:00 am to 4:00 pm	General public	Any
Greater Hartford Commuter Express Bus (CT Transit)	Colchester, Windham	Hartford	Monday-Friday	5:45 am to 8:30 am, 12:00 pm to 6:45 pm	General public	Any

* indicates within the study area for the SEAT Comprehensive Service Analysis.

Demand Generators

Figure 1, Figure 2, and Figure 3 show demand generators (i.e. major destinations in the region) overlaid on SEAT and New London County DAR service area boundaries. Major destinations include: senior centers and adult day centers; human service agencies; hospitals and medical centers; dialysis facilities; retail centers; libraries; and colleges and universities.

The majority of the demand generators are concentrated in New London, Norwich, Groton, Ledyard, East Lyme, Lisbon, Stonington, and Southern Waterford. During the week, the most of the demand generators

are served by the SEAT, with a few exceptions. On the weekend, there are additional demand generators that are not served by existing public transportation, except the New London County DAR service. The demand generators not served by public transportation are shown in Table 2.

Medical destinations throughout the study area are served by the New London County DAR service 24 hours a day seven days per week; however this *service is limited to seniors and people with disabilities who live in Bozrah, East Lyme, Griswold, Groton, Lisbon, Ledyard, New London, Stonington, Waterford, and North Stonington*. Each participant is only allowed 24 one-way trips per year on the New London County DAR service.

TABLE 2 | DEMAND GENERATORS WITH LIMITED PUBLIC TRANSIT OPTIONS

Demand Generator	Service Available	Days Available	Days Unavailable	Populations Served
Lebanon [Senior Center]	WRTD DAR	Monday-Friday	Saturday & Sunday	General Public only to the WRTD service area
Windham [Senior Center]	WRTD DAR	Monday-Friday	Saturday & Sunday	General Public only to the WRTD service area
Preston [Grocery Store]	New London County DAR	Seven days a week	None	Elderly & Disabled
Bozrah [Senior Center, Grocery Store]	New London County DAR	Seven days a week	None	Elderly & Disabled
Griswold [Dialysis Facility]	New London County DAR	Seven days a week	None	Elderly & Disabled
East Lyme [Senior Center, Grocery Stores, Assisted Living Facility]	New London County DAR SEAT	Seven days a week Monday-Friday	None Saturday & Sunday	Elderly & Disabled General Public (M-F only)
Waterford [Hospital, Grocery Stores]	New London County DAR SEAT	Seven days a week Monday-Saturday	None Sunday	Elderly & Disabled General Public (M-Sa only)
Lisbon [Senior Center, Grocery Stores]	New London County DAR SEAT	Seven days a week Monday-Saturday	None Sunday	Elderly & Disabled General Public (M-Sa only)
Ledyard [Hospital, Grocery Stores]	New London County DAR SEAT	Seven days a week Monday-Saturday	None Sunday	Elderly & Disabled General Public (M-Sa only)
Norwich [Hospitals, Assisted Living Facility, Services for People with Disabilities]	SEAT	Monday-Saturday	Sunday	General Public (M-Sa only)

Source: Southeast Area Transit District, New London County Dial-A-Ride, and internet search.

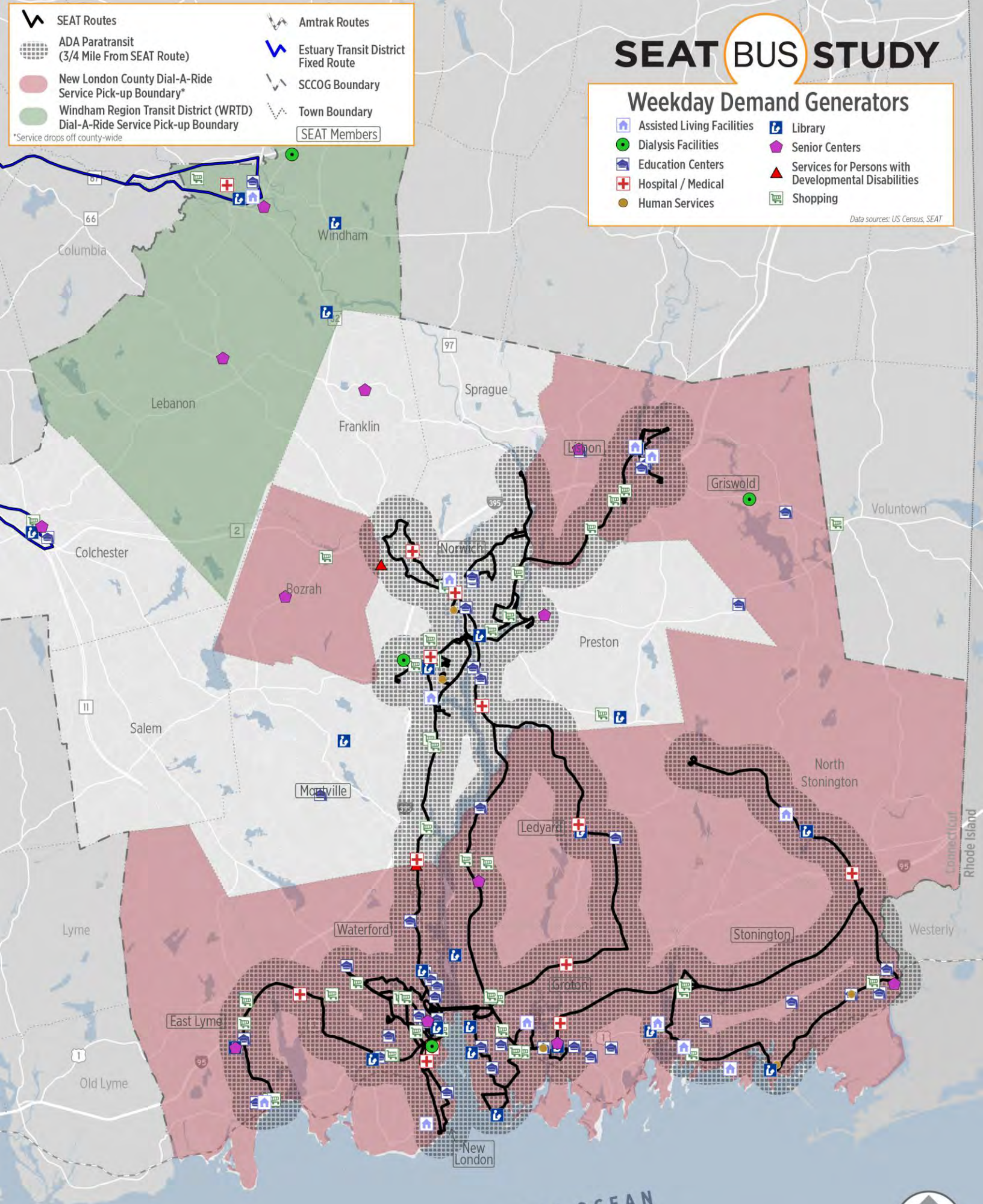

FIGURE 1 | WEEKDAY DEMAND GENERATORS

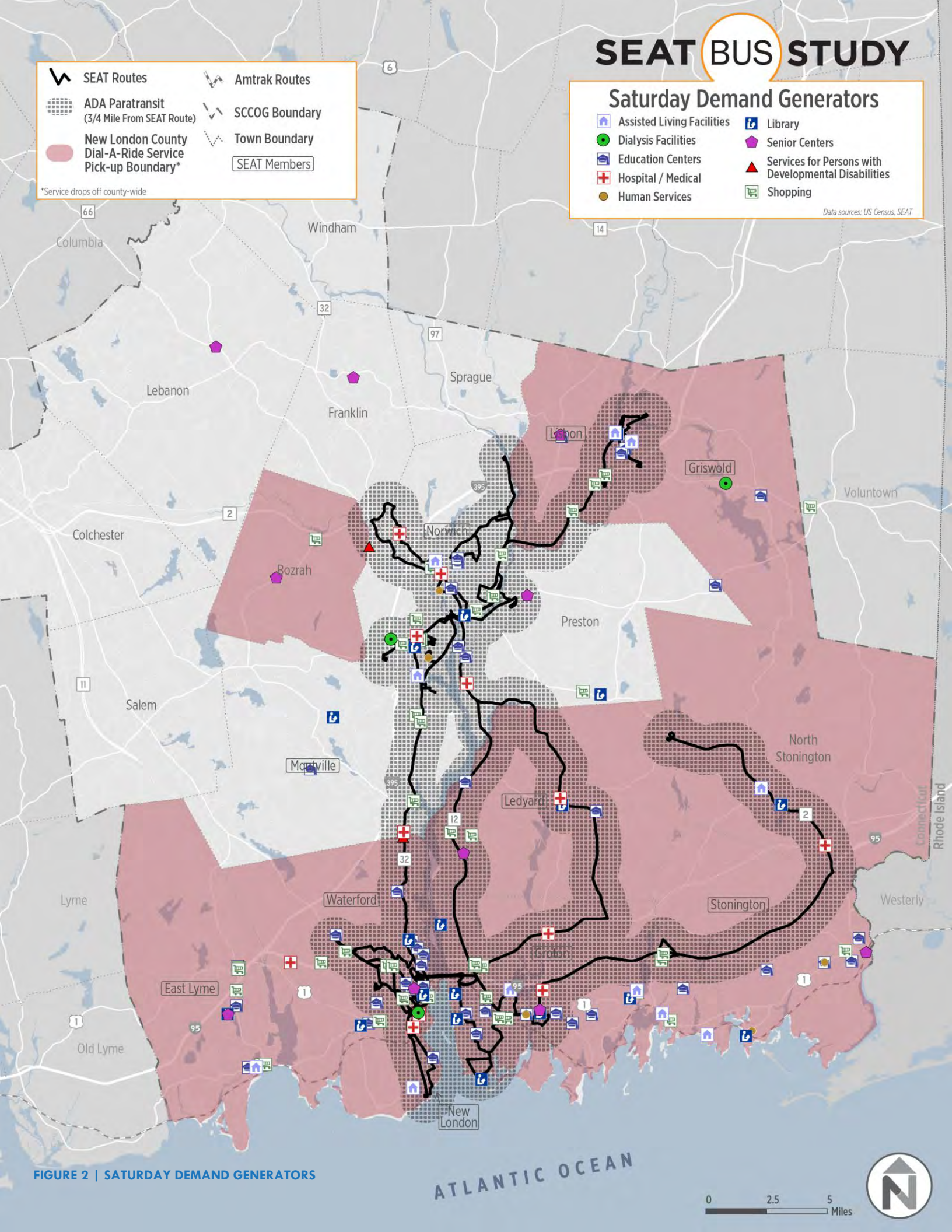

FIGURE 2 | SATURDAY DEMAND GENERATORS

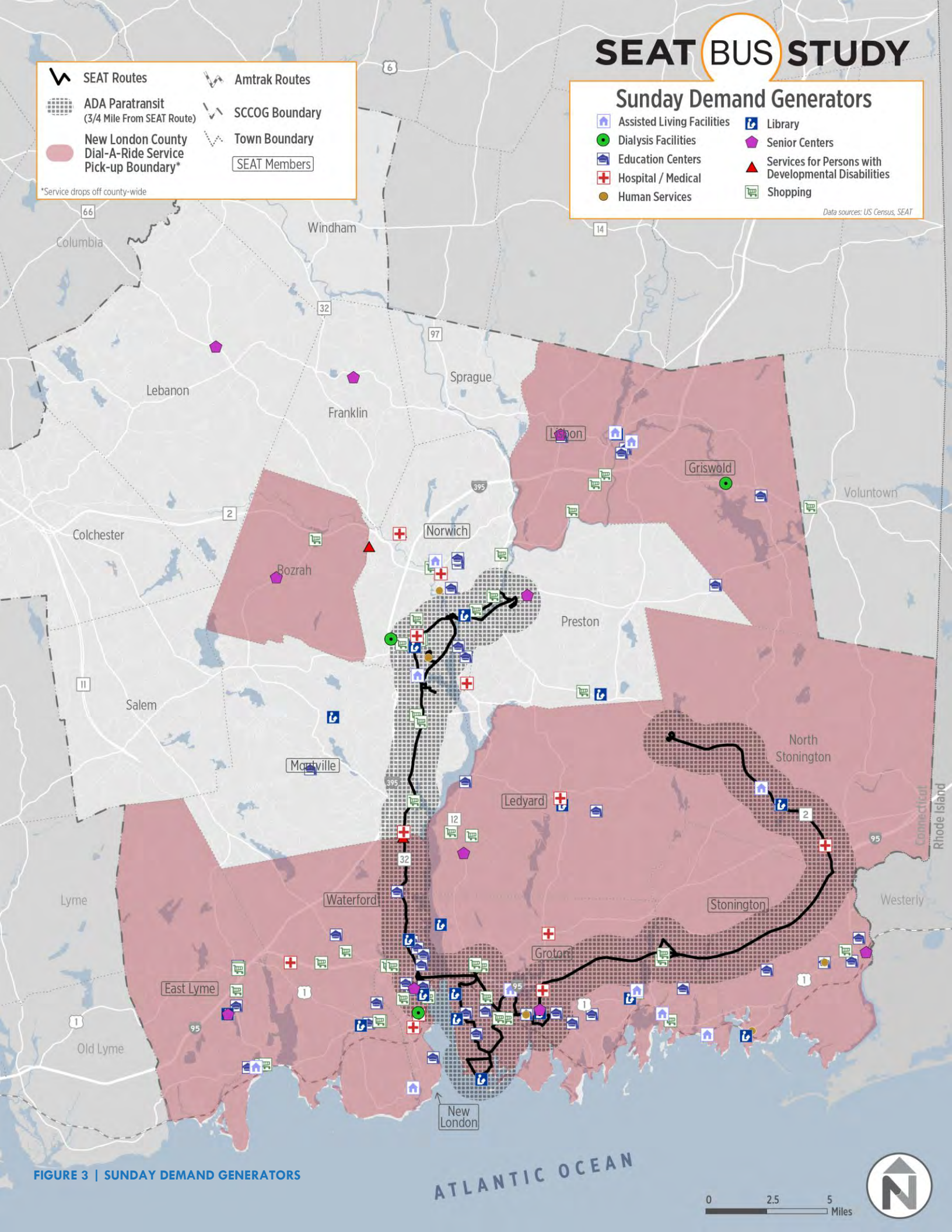

FIGURE 3 | SUNDAY DEMAND GENERATORS

Transit Needs Composite Index

In addition to demand generators, Figure 4, Figure 5, and Figure 6 show the Transit Needs Composite Index, which identifies the areas with the highest density of persons who fall into four high need categories: older adults, people with disabilities, people with low income, and people without a vehicle.

Many of the areas with high transit needs are served by **weekday** SEAT services and the New London County DAR service including Norwich, New London, Waterford, Ledyard, Stonington, and Lisbon. Colchester has the highest need for transit service because it is the only municipality without transit service to access the rest of the region. The Greater Hartford Express Bus that picks up in Colchester only travels to destinations north and is express service to Hartford.

Other areas with high to moderate transit needs are shown in Table 3. Although the table shows the municipalities that are the most limited in terms of transit service available, it does not show the areas within each municipality that are not walkable to transit. Every municipality in the region has specific neighborhoods and communities that are outside of the walkable distance from transit stops (.25 and .5 miles depending on an individual's ability); individuals who live within these communities are just as limited as those living in the municipalities with the highest need for service.

TABLE 3 | TRANSIT NEEDS COMPOSITE – AREAS WITH LIMITED OR NO SERVICE

Municipality	Level of Need	Service Available	Days Available	Days Unavailable	Population Served
Colchester	High	Greater Hartford Express Bus	Monday-Friday	Saturday & Sunday	General Public
Waterford	High	New London County DAR	Seven days a week	None	Elderly & Disabled
Griswold	High	New London County DAR	Seven days a week	None	Elderly & Disabled
Ledyard	High	New London County DAR SEAT	Seven days a week Monday-Saturday	None Sunday	Elderly & Disabled General Public (M-Sa only)
Lisbon	High	New London County DAR SEAT	Seven days a week Monday-Saturday	None Sunday	Elderly & Disabled General Public (M-Sa only)
Windham	Moderate	WRTD DAR	Monday-Friday	Saturday & Sunday	General Public
Lebanon	Moderate	WRTD DAR	Monday-Friday	Saturday & Sunday	General Public

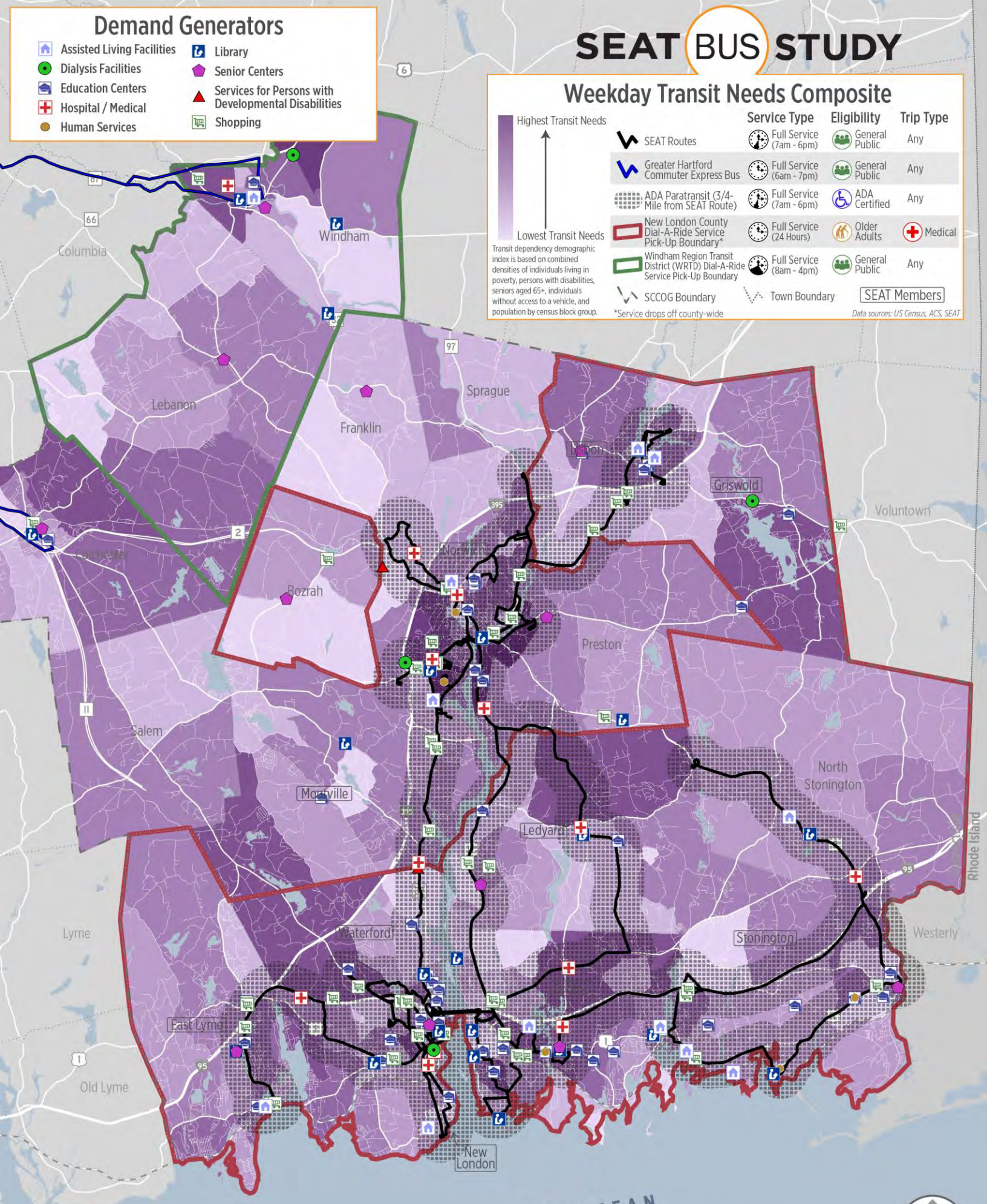

FIGURE 4 | WEEKDAY TRANSIT NEEDS COMPOSITE

SEAT BUS STUDY

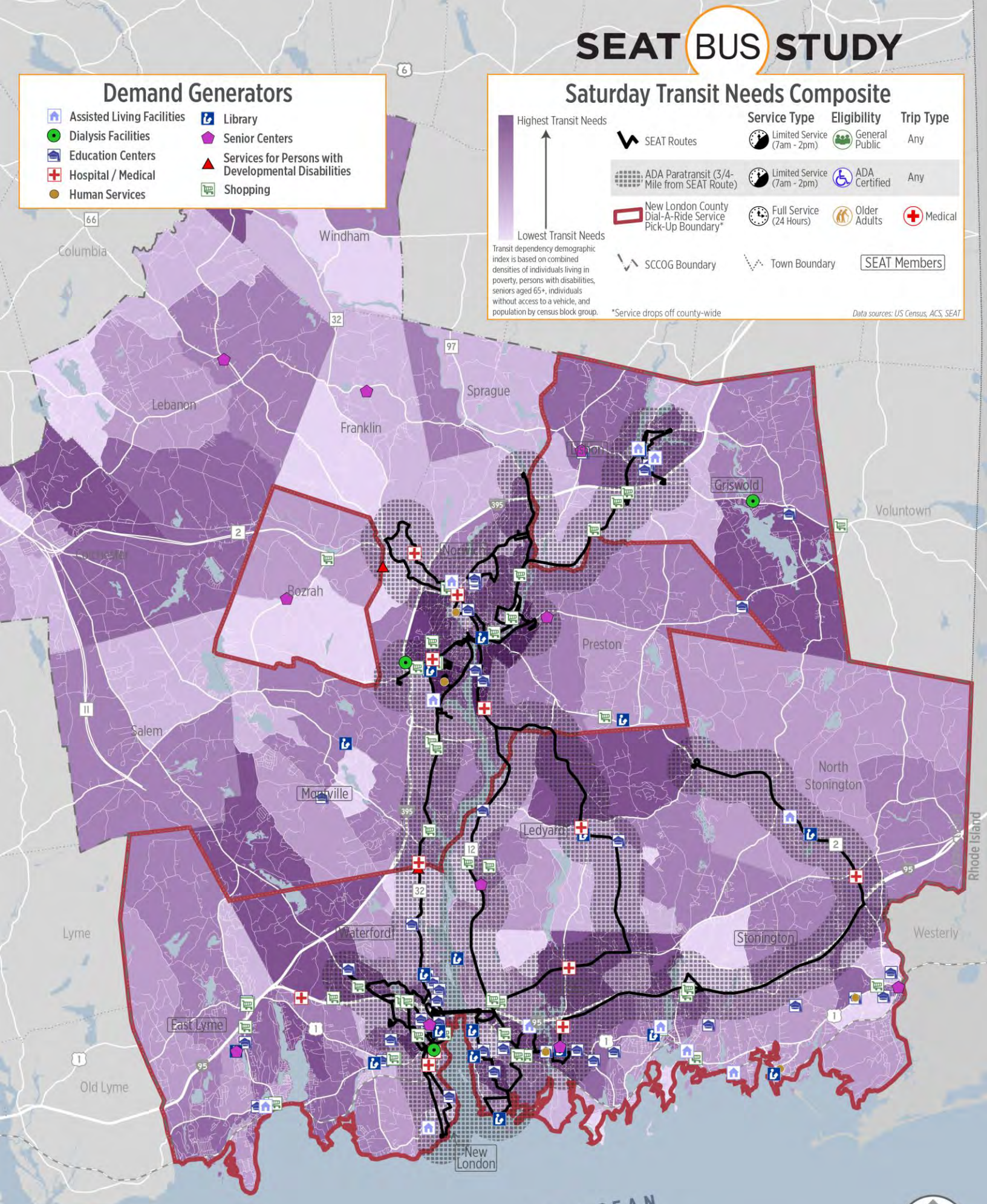

FIGURE 5 | SATURDAY TRANSIT NEEDS COMPOSITE

SEAT BUS STUDY

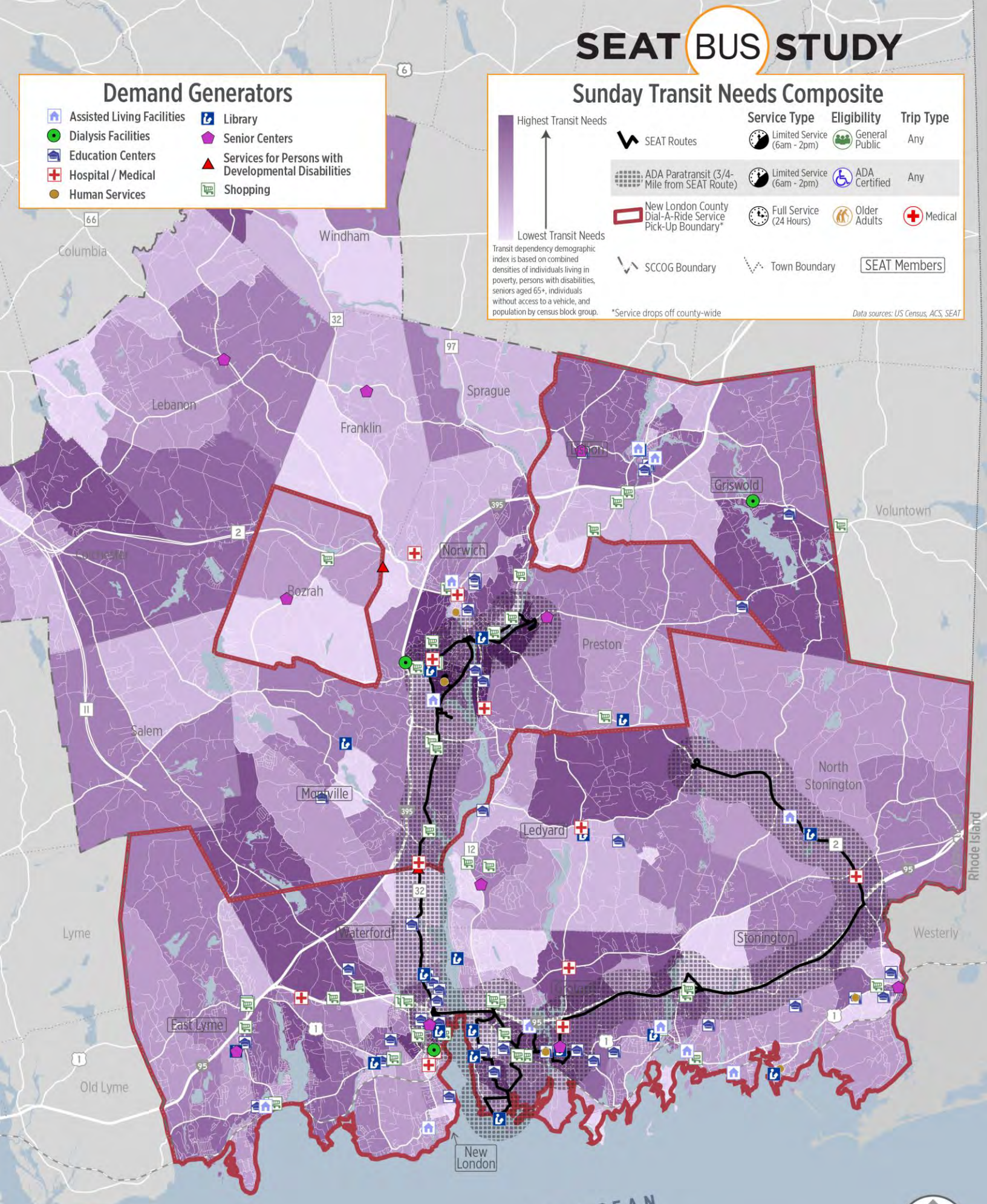

FIGURE 6 | SUNDAY TRANSIT NEEDS COMPOSITE

Senior Transportation

There are 16 individual senior[1] transportation services operating in the region. The majority of these services are operated by municipal senior centers providing transportation only to town residents and travel only within town borders (and occasionally to adjacent towns). Some services routinely travel to bordering towns. Senior Transportation services are detailed below in Table 4 and depicted in Figure 7. Analysis of the service gaps for seniors in the study area is provided in the Summary of Findings.

TABLE 4 | SENIOR TRANSPORTATION (WEEKDAY ONLY)

Service Name	Service Origin	Service Destination	Service Days	Service Times	Client Eligibility	Trip Type
Bozrah Senior Transportation (ECTC Contract Service)	Bozrah	Bozrah, Franklin, Norwich	Friday	8:30 am to 4:30 pm	Age, Residency	Any
Colchester Senior Center	Colchester	Colchester	Monday – Friday	8:30 am to 4:00 pm	Age, Residency	Any
East Lyme Senior Center	East Lyme	East Lyme	Monday – Friday	9:00 am to 3:00 pm	Age, Residency	Any
Franklin Senior Transportation (ECTC Contract Service)	Franklin	Franklin, Bozrah, Norwich	Tuesday	8:30 am to 4:30 pm	Age, Residency	Any
Griswold Senior Center	Griswold	Griswold, Norwich	Monday-Friday	8:00 am to 2:00 pm	Age, Residency	Any
Groton Senior Center	Groton	Groton, towns that border Groton	Monday-Friday	10:00 am to 2:30 pm	Age, Residency	Any
Lisbon Senior Center	Lisbon	Lisbon	Monday-Friday	9:00 am to 3:00 pm	Age, Residency	Any
Med Ride I	Norwich, New London, Montville, Colchester	Norwich, New London, Montville, Colchester	Monday-Friday	9:00 am to 3:00 pm	Age, Residency	Medical only
Med Ride II	Statewide	Statewide	Monday-Friday	9:00 am to 3:00 pm	Disabled, Age Residency	Medical only
New London Senior Center	New London	New London, Waterford	Monday-Friday	8:30 am to 2:45 pm	Age, Residency	Medical, Grocery (Tuesdays)
Pawcatuck Neighborhood Center	Stonington	Stonington	Monday-Friday	9:00 am to 3:00 pm	Age, Residency	Any
Rose City Senior Center	Norwich	Norwich	Monday-Friday	8:00 am to 3:30 pm	Age, Residency	Any
Sprague to Occum Bus	Sprague	Occum	Monday-Thursday	7:45 am to 2:15 pm	General Public Residency	Any
Town of Montville	Montville	Montville, New London, Waterford, Norwich	Monday-Friday	8:00 am to 2:00 pm	Age, Residency	Shopping
Town of Preston	Preston	Preston	Monday-Friday	9:00 am to 3:00 pm	Age, Residency	Any
Waterford Senior Services	Waterford	East Lyme, New London, Waterford	Monday-Friday	8:30 am to 3:30 pm	Age, Residency	Any

[1] *The term "senior" varies from age 55 to age 65 depending on each senior center's eligibility requirements.*

SEAT BUS STUDY

Demand Generators

- Assisted Living Facilities
- Dialysis Facilities
- Education Centers
- Hospital / Medical
- Human Services
- Library
- Senior Centers
- Services for Persons with Developmental Disabilities
- Shopping

Other Service Providers

Norwich / New London Montville / Colchester
Med Ride 1
9:00 AM - 3:00 PM

Statewide
Med Ride 2
9:00 AM - 3:00 PM

Weekday Senior Transportation

Trip Type
- Medical Trips
- Program Trips
- Shopping Trips

Advanced Notification
- Next Day
- 2 Business Days
- Call Well in Advance; Limited Capacity

Service Time
#:00 AM - #:00 PM

Eligibility
- All Trips for Residents Only
- All Trips for Older Adults Only
- All Trips Wheelchair Accessible

Data sources: US Census, ACS, SEAT

Lebanon
Sprague
7:45 AM - 2:15 PM
Franklin
8:30 AM - 4:30 PM
Lisbon
9:00 AM - 3:00 PM
Griswold
8:00 AM - 2:00 PM
Voluntown
Colchester
8:30 AM - 4:00 PM
Norwich
8:00 AM - 3:30 PM
Bozrah
8:30 AM - 4:30 PM
Preston
8:00 AM - 3:00 PM
Salem
North Stonington
Montville
8:00 AM - 2:00 PM
Ledyard
Connecticut
Rhode Island
Lyme
Waterford
8:30 AM - 3:30 PM
Stonington
9:00 AM - 3:00 PM
Westerly
Groton
10:00 AM - 2:30 PM
East Lyme
9:00 AM - 3:00 PM
Old Lyme
New London
8:30 AM - 2:45 PM
ATLANTIC OCEAN

0 2.5 5 Miles

FIGURE 7 | SENIOR TRANSPORTATION SERVICES

Human Service Transportation (HST)

Human Service Transportation (HST) in the study area is provided by hospitals, towns, non-profits, and human service organizations for seniors and people with disabilities. There are seven HST services in the region. Many of these services are restricted to program clients for certain trip types. HST services are detailed in Table 5 and depicted in Figure 8 and Figure 9. Analysis of the service gaps for HST in the study area is provided below in the Summary of Findings.

TABLE 5 | HUMAN SERVICE TRANSPORTATION

Service Name	Service Origin	Service Destination	Service Days	Service Times	Client Eligibility	Trip Type
Natchuag Hospital	SCCOG Area	Natchuag Hospital	Monday-Friday	8:00 am to 3:00 pm	Hospital client with appointment	Medical Only
Northeast Placement Services, Inc.	Windham	Windham	Monday-Friday	7:00 am to 5:00 pm	Program clients	Employment
Reliance House	SCCOG Area	SCCOG Area	Monday-Friday	8:00 am to 3:00 pm	Program clients	Any
The Arc of New London	New London	New London	Monday-Friday	8:00 am to 3:00 pm	Program clients	Employment
The Arc of Quinebaug Valley	SCCOG Area	SCCOG Area	Monday-Friday	8:00 am to 4:30 pm	Program clients	Program-specific
Town of Sprague	Sprague	Sprague	Monday-Friday	8:00 am to 3:00 pm	Age, Disability, Residency	Any
Windham Region Medical Transportation	Windham	Windham	Monday-Friday	8:00 am to 2:30 pm	Age, Disability, Residency	Medical Only

Alternative Programs

There are several volunteer driver, voucher, reimbursement, and combination programs available in the study area, as shown in Table 6.

- **The Eastern Connecticut Transportation Consortium (ECTC)** operates a **taxi/private operator voucher program funded** through New Freedom (which is now Section 5310). Individuals must reside within Eastern Connecticut and must have a physical or mental impairment that substantially limits one or more major life activities. Travel vouchers can be used for transportation throughout Eastern Connecticut. Travel vouchers can only be used with four private carriers: Alternative Transportation Solutions, Curtin Transportation Group, Putnam Taxi, and Yellow Cab.

  Participants can use vouchers during the days and hours that the private carriers are operating; generally the private carriers operate seven days a week, 24 hours per day. Vouchers are formatted as scrip; each voucher has a dollar amount, which the participant gives to the transportation provider to pay for a trip.

  There are 211 total participants in the travel voucher program and about 20% of them use the program on a regular basis. The total cost of the program in 2013 was $41,000, with the consumer paying 50% (so ECTC costs were $20,500). The voucher program was developed as a safety net for people with disabilities. These individuals are encouraged to take advantage of community transportation options, such as senior centers (for older adults) and human service transportation operators before using the vouchers due to the high cost of purchasing vouchers. The vouchers are available as a last resort option for accessing destinations that are not served by existing resources.

- **The ECTC Caregiver Mileage Reimbursement program** is also available to the same individuals who are eligible for the New London County DAR service (seniors and people with disabilities living in Bozrah, Lisbon, Griswold, East Lyme, Groton, New London, Waterford, Ledyard, Stonington, and North Stonington. The program reimburses volunteer drivers for the standard IRS amount. Participants are required to recruit and retain their own drivers and sign a waiver saying that they are riding at their own risk. ECTC does not interact with volunteer drivers due to strict liability policies.
- **The American Cancer Society Road to Recovery program** operates a volunteer driver program for cancer patients to get to cancer treatment. This program is available nationwide. Participants must call a regional phone number to schedule their rides far in advance of their appointments. The American Cancer Society recruits, retains, and coordinates volunteer drivers that are only utilized for their program.
- **Seniors Helping Seniors** provides volunteer drivers to transport seniors to appointments, shopping, and recreational trips. The program operates in the majority of the towns in the study area. Seniors must apply to participate in the program and it is limited by the number of volunteers available and the days/times that volunteers are available to provide services (which may or may not be on the weekend)
- **The ECTC Disabled Veterans Alternative Transportation Program** is a mileage reimbursement program to aid veterans in obtaining transportation to non-VA medical facilities, such as to a specialist or to the dentist. To be eligible the veteran must reside in Eastern Connecticut and have an approved disability. The service is intended to provide supplemental transportation and allow for greater medical appointment flexibility for eligible veterans. It does not replace current VA transportation programs, such as the mileage reimbursement or the Disabled American Veterans (DAV) programs.
- **The ECTC Rides for Jobs Program** is funded by the Eastern Connecticut Workforce Investment Board and the Department of Social Services. The program provides bus tickets, taxicab reimbursement, and mileage reimbursement for TANF-eligible individuals who meet the income guidelines and are referred by a caseworker. Transportation to employment and daycare is provided for up to 60 days.

TABLE 6 | VOLUNTEER DRIVER AND VOUCHER PROGRAMS

Service Name	Service Origin	Service Destination	Service Days	Service Times	Client Eligibility	Trip Type
Seniors Helping Seniors Volunteers	Griswold, North Stonington, Stonington, Groton, Ledyard, Preston, Norwich	Griswold, North Stonington, Stonington, Groton, Ledyard, Preston	Varies	Varies	Age, Residency	Any
American Cancer Society Road to Recovery Volunteers	SCCOG Area	SCCOG Area	Monday-Friday	8:00 am to 5:00 pm	Cancer Patient	Medical
Eastern Connecticut Transportation Consortium (ECTC) Caregiver Mileage Reimbursement	Bozrah, Griswold, Lisbon, East Lyme, Groton, New London, Waterford, Ledyard, Stonington, and North Stonington	SCCOG Area	Seven days a week	Varies	Seniors and/or disability	Any
ECTC Disabled Veterans Alternative Transportation Program	Eastern Connecticut	Eastern Connecticut	Seven days a week	Varies	Veteran, Disability	Non-VA medical appointments
ECTC Rides for Jobs	Eastern Connecticut	Eastern Connecticut	Seven days a week	Varies	TANF-eligible	Employment, Daycare
ECTC Voucher Program	Eastern Connecticut	Eastern Connecticut	Seven days a week	24 hours a day	Disability	Any

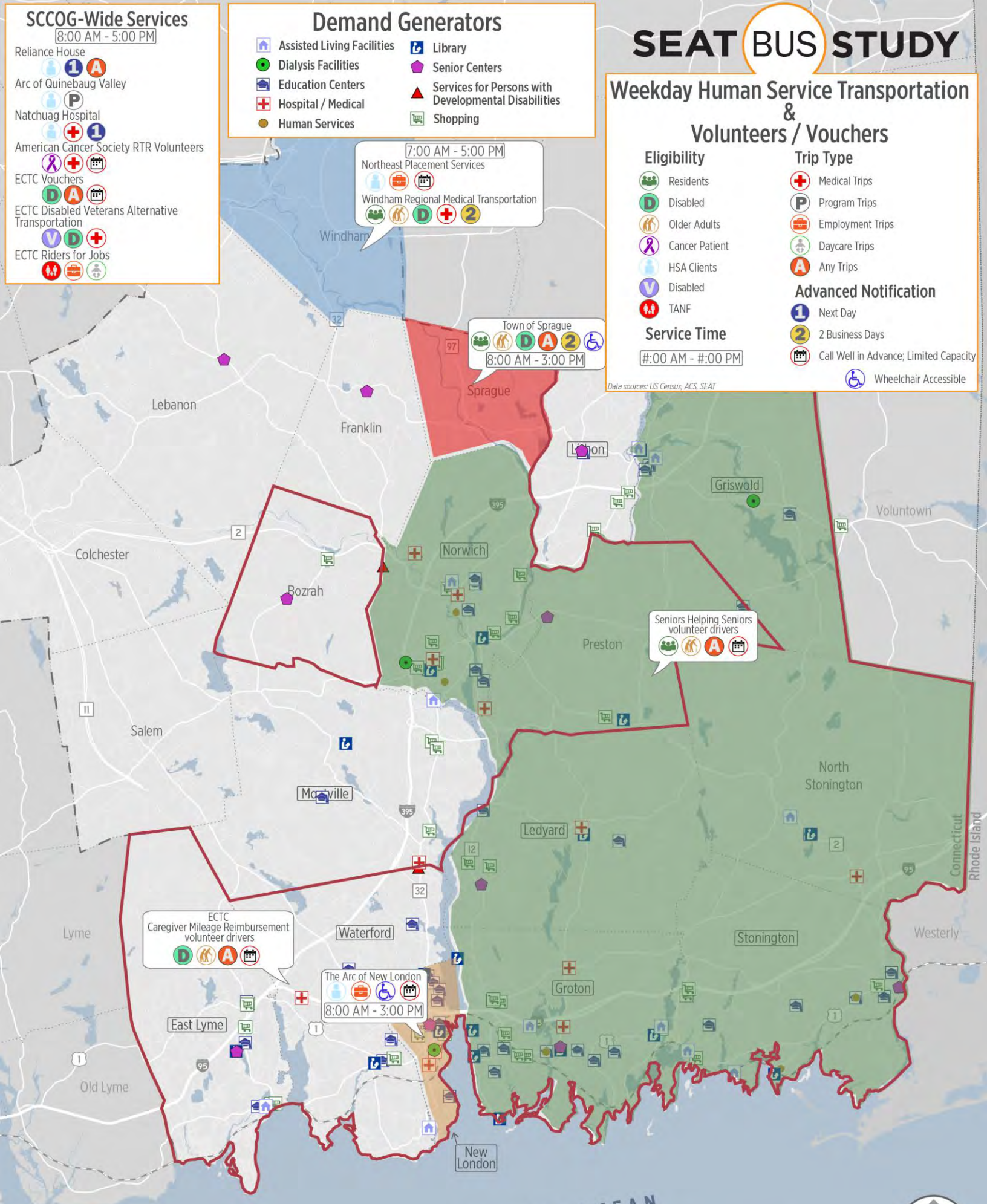

FIGURE 8 | WEEKDAY HUMAN SERVICE TRANSPORTATION (HST)

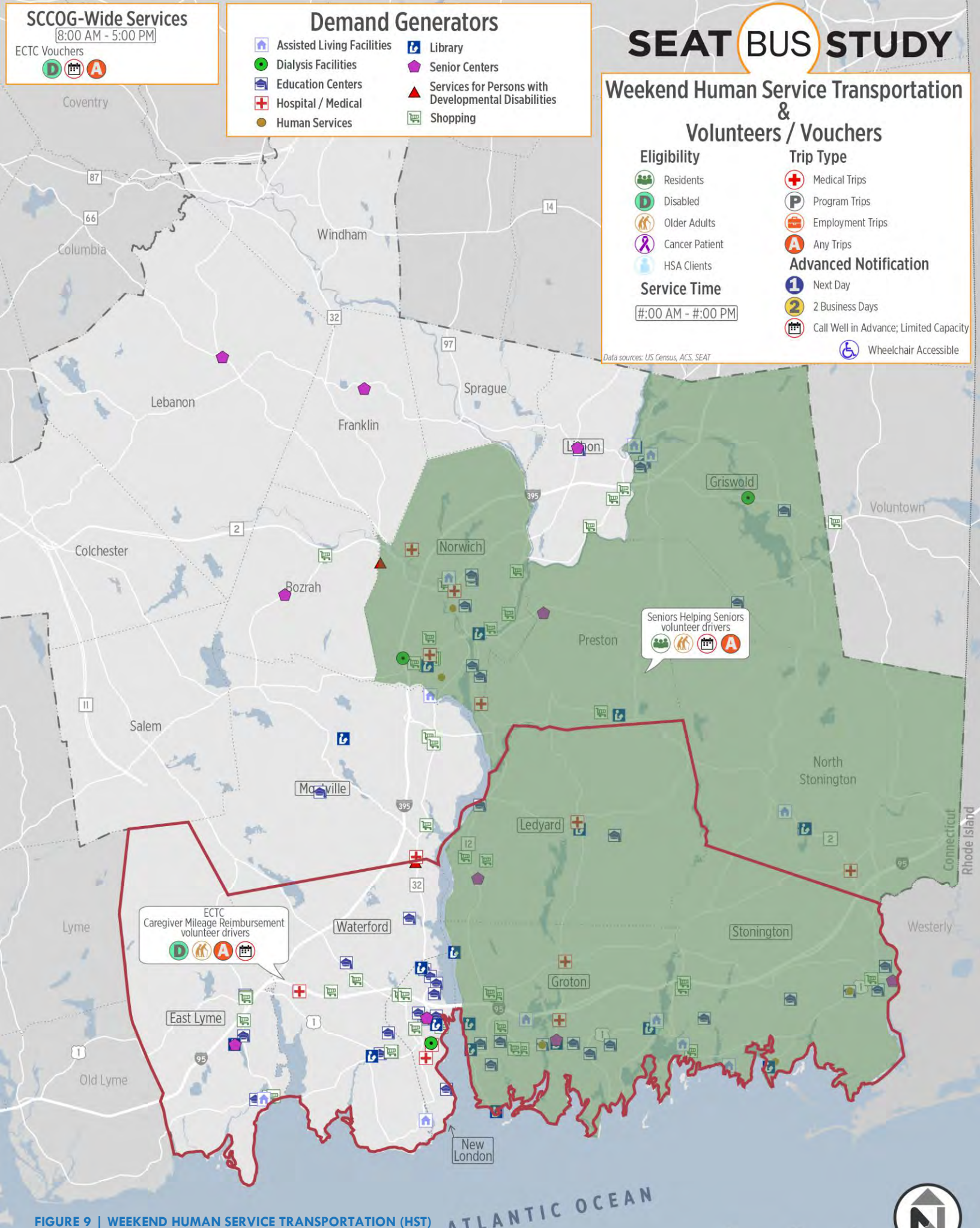

FIGURE 9 | WEEKEND HUMAN SERVICE TRANSPORTATION (HST)

3 SUMMARY OF FINDINGS

The study area has a complicated network of services and providers that transport individuals in the region, many of whom fall into the transit dependent population groups discussed above. The region offers a large number of different transportation resources that provide services for these target groups however, service gaps do exist in the form of four types of limitations: spatial, temporal, client eligibility, and trip purpose, as detailed below.

Spatial Limitations

The region has an extensive network of transportation services; in fact, no municipality is without at least one transportation option, and the majority of municipalities have access to fixed route service (SEAT and WRTD service) as well as senior transportation and voucher and volunteer programs. Considering the complicated web of various services available in the region, it would appear that spatial limitations do not exist, but this assumption would be incorrect. At quick glance, the maps in previous chapters show that Salem is the only municipality lacking any public transportation and senior transportation; however, many communities in other municipalities are just as limited as Salem because SEAT service only travels along the main corridors. The neighborhoods just outside of the walkable .25 or .5 mile distance from the SEAT service area are limited because individuals who live in these areas need to find another transportation source, such as a friend or neighbor, to bring them to the SEAT bus stops in order to access the service. While there are additional transportation resources for seniors and people with disabilities in some of these communities, many individuals do not fit the eligibility requirements of these programs and are left without options.

Temporal Limitations

Weekday Peak Services

During the week, SEAT services are available from 7:00 am to 6:00 pm. The New London County DAR service is available 24 hours a day, 7 days per week and is the only service available in the region after 6:00 pm; however, this service is limited to medical trips only and residents of participating towns. This lack of evening service can be detrimental to evening shift employees, especially those working in local casinos and hospitals, and janitorial/cleaning staff.

Senior and human service transportation (HST) services are only available during the week. The majority of the senior transportation options end services at 3:00 pm. Only one service (Colchester Senior Center) provides transportation until 4:00 pm. HST providers generally end service between 3:00 pm and 5:00 pm. Volunteer driver programs are available in certain towns, but it may be difficult to recruit a driver in the evenings. The ECTC voucher program is available for people with disabilities in the evening, but this program can be costly.

Weekend/Evening Services

On the weekend, with limited SEAT service, no WRTD DAR service, no senior transportation, and no human service transportation, individuals outside of the SEAT service area are limited to the New London County DAR service (medical trips only for residents of five towns), ECTC vouchers (disabled-only and costly), and the various volunteer driver programs (restricted by volunteer's availability). Individuals have additional options if they are a veteran or are in the Rides to Job program (which is temporary). Individuals who are not eligible for these special services will not have access to weekend and evening

transportation services. Many individuals in the region work off-peak shifts, such as those at the casinos, hotels, and restaurants that are part of the region's bustling tourist attractions and are forced to put together patched-together transportation schedules through rides with coworkers, family and friends, or paying for a taxi ride, which can cost almost an entire day's wages.

Client Eligibility

Age

There are 16 senior transportation services available in the region, which provide adequate ***weekday*** coverage to the majority of the senior centers. Some senior centers are also covered by weekend SEAT service, including Ledyard (Saturday only), New London, and Norwich. Most of the senior transportation services are available for senior residents of a specific town and only provide transportation services within the borders of that town or to adjacent towns. Lebanon and Ledyard are the only municipalities not served by senior transportation; however Lebanon is served by WRTD DAR and Ledyard is served by SEAT ADA.

Additionally, the Med Ride I service provides demand response transportation for seniors in Norwich, New London, Montville, and Colchester and the Med Ride II provides transportation for seniors statewide. Both of these services are available for medical trips only.

It's clear that seniors have more transportation options than individuals who are not seniors; however, even seniors are restricted by the day of the week and time of day and where they can travel. None of the senior centers provide transportation on the weekend or after 4:30 pm. As described, most of the services only travel within the municipality of origin or only travel to neighboring municipalities. Below are specific examples of situations where senior transportation services are limited[2]:

- Seniors who live within North Stonington, Ledyard, Lebanon, Windham, and Salem who want to travel for any trip type other than medical trips and do not live within the SEAT or WRTD service area. These four municipalities do not have senior transportation services. Only North Stonington and Ledyard participate in the Seniors Helping Seniors volunteer driver program.
- A senior who lives in Lisbon and wants to travel outside of Lisbon for a social event is limited because the Lisbon Senior Transportation service does not travel outside of Lisbon. Lisbon is also outside of the Seniors Helping Seniors boundary.
- A senior who lives in Stonington and needs to travel to neighboring North Stonington for a medical appointment at 4:00 pm is restricted from doing so because the senior service ends at 3:00 pm and does not travel outside of Stonington.

Disability

People with disabilities have many options and are generally well-covered by transportation services in the study area:

- SEAT fixed route and ADA Paratransit serving the most populated sections of the study area (weekdays and weekends)
- New London County DAR service for medical trips serving the southern part of the study area (24 hours/7 days per week)
- WRTD DAR service for the general public that serves Lebanon and Windham in addition to other communities north of Windham. The Town of Windham also provides medical transportation for senior and disabled residents within Windham.
- Senior Transportation Services in various towns (seniors only, weekdays only)

[2] *These are only a few of many specific examples of gaps in service that are currently occurring in the region.*

- The Town of Sprague provides weekday transportation for senior and disabled residents traveling within town borders.
- People with disabilities who live within the New London County DAR service area towns are able to participate in the ECTC Caregivers Mileage Reimbursement program if they are able to recruit their own drivers.

Additionally, the ECTC travel voucher program provides a flexible catchall transportation option for people with disabilities; however if an individual is low-income they may not be able to participate in this program because it is cost-prohibitive.

However, even for people with disabilities, there are several situations in which certain individuals can fall through the cracks. For example[3]:

- Individuals who live outside of the SEAT, New London County DAR, and WRTD service areas, such as individuals who live in parts of Montville, Salem, Colchester, Preston, Franklin, and Sprague and cannot afford the ECTC travel voucher.
- Individuals who live within the SEAT, New London County DAR, and WRTD service areas, but want to travel outside of service hours and cannot afford the ECTC travel voucher.
- Individuals who live do not qualify for SEAT Paratransit service and live outside the WRTD and New London County DAR service areas, cannot afford the ECTC travel voucher, and do not have access to a friend or family member who will drive them via the ECTC Caregivers Mileage Reimbursement program.

Low Income

There is one program in place to assist low-income workers who need to access employment opportunities. Individuals who are TANF-eligible may qualify for ECTC's "Ride for Jobs" program which provides mileage reimbursement, taxicab payment, and bus tickets for up to 60 days. If an individual is not eligible for this program or the 60 day period has expired, they may be out of options, especially if they live outside of the service area for transit or need to travel to employment during off-peak periods and the weekends. For example, a low-income worker living just above the TANF income level in the far western side of East Lyme does not have access to SEAT services and does not qualify for the ECTC Ride to Jobs program.

Trip Purpose Limitations

Medical

With a few exceptions, the study area is well-covered by transportation options for getting to medical appointments. There are several programs available:

- The New London County DAR service provides medical transportation to senior and disabled residents of Bozrah, Lisbon, Griswold, East Lyme, Groton, New London, Waterford, Ledyard, Stonington, and North Stonington.
- The Med Ride I is available to senior residents of Norwich, New London, Montville, and Colchester for transportation within those towns.
- The Med Ride II is available for seniors regardless of where they live for medical transportation throughout the state. Both of the Med Ride 1 and the Med Ride 2 are at capacity and require reservations far in advance.

[3] *These are only a few of many specific examples of gaps in service that are currently occurring in the region.*

- The American Cancer Society provides rides for cancer patients to cancer treatment appointments throughout the study area and the state.
- Natchaug Hospital provides rides for clients without transportation options from their homes to the hospital for scheduled medical appointments.
- Windham Medical Transportation provides medical transportation to disabled and elderly Windham residents who do not have any other transportation options or insurance. This service is for medical trips within the town of Windham and occasionally to medical facilities in other towns, including Hartford and New Haven. This program is funding through an Elderly and Disabled grant through WRTD. The client has to be screened for this service, through the Town of Windham Human Services Department. Individuals who are eligible can only use the service for eight round trips per year.

Individuals who are not seniors and do not have a disability are more limited. Those who do not live within the SEAT or WRTD service or the New London County DAR may be out of transportation options. For example, a middle-aged, able-bodied man who lives in the middle of Preston is not within walking distance of the SEAT service. He is not eligible for ECTC vouchers or caregiver mileage, nor can he benefit from the Med Ride I or the Med Ride II, because he is not a senior or a person with disabilities.

Non-Medical Trips

Transportation for non-medical reasons, such as trips to social events, grocery shopping, employment, and educational opportunities are even more difficult to obtain. SEAT's and WRTD DAR service are both available to the general public for any trip purposes, but the New London County DAR service is only available for medical trips and is only eligible for seniors and people with disabilities. The sixteen senior transportation resources will, for the most part, provide non-medical trips, but only to older adults. The ECTC caregiver mileage is only available for seniors and people with disabilities living within the New London County DAR boundary and the ECTC voucher program is only available for people with disabilities.

For employment trips, TANF-eligible individuals may qualify for a program called "Ride for Jobs" program provided by ECTC and funded by the Eastern Connecticut Workforce Investment Board and the State of Connecticut Department of Social Services. This service provides mileage reimbursement, bus tickets, taxicab payments, but is only offered for 60 days. Nonetheless, if an able-bodied non-senior lives outside of the SEAT or WRTD service area, which accounts for a large number of people in the region, they have very limited options when traveling for non-medical reasons, such as to employment, social events, educational opportunities, and to run errands.

Other Limitations

Transportation for Children

The lack of transportation for children is also a major challenge for the region. Families with children who have ongoing medical needs are especially vulnerable because they often have to balance several competing needs simultaneously. Families with multiple children need to transport a sick child to medical care while also transporting other children to childcare. At the same time, the adults in the family need to get to work on time or risk losing their job. There are very limited options for these families in the region. The ECTC Ride to Jobs program will transport adults to employment and children to childcare and medical assistance; however, this program is only available to TANF-eligible individuals and is only available for 60 days. There are no other safety nets for these families available in the region.

Cost of transportation

Another concern for low-income families and individuals in the region is the high cost of transportation, especially the cost of alternative options in the evening and on the weekends when SEAT and other transit

services are not available. Those who live outside of the SEAT service area and do not qualify for senior services or human service transportation are even more limited. Frequently, low-wage workers employed at area casinos, restaurants, and other service industry jobs will work off-peak shifts that end late in the evening or are scheduled on the weekend. These workers will have a ride to work, but will have to piece together a schedule for a ride home after their shift ends. Many times they will ride with coworkers; however, when this is not an option, workers will have to call a cab, which can cost almost a whole day's wages.

Pedestrian Access

The lack of safe pedestrian access to SEAT and other fixed route services is also a concern for the region. Many SEAT services operate on state highways that have limited pedestrian facilities. This is particularly challenging during winter months when the sidewalks are impassable due to snow pile-up. During the winter many SEAT riders are forced to walk in the shoulder on road in order to access SEAT services, which is a safety hazard.

Summary

At quick glance, the region would appear to have a comprehensive web of transportation services that cover the majority of the individuals in the region; however, a closer analysis shows that there are many gaps in service that should be addressed. Although the below examples only represent a fraction of the service gaps experienced by individuals, their purpose is to point to specific cases where additional transportation connections can be made and draw conclusions about other similar service gaps across the region.

Below are a just a few examples of individuals who are limited spatially by transportation services in the region.

- A young woman who lives in Montville outside of the SEAT service area does not qualify for the senior services provided by the Montville Senior Center. She also is not eligible for the resources for people with disabilities, such as the ECTC vouchers.
- A teenager who needs to travel from Windham to Norwich for his summer job as an evening waiter does not have access to public transit resources and is not eligible for human service or senior resources.
- A senior who wants to travel from Colchester to New London for a medical appointment is limited to the Med Ride II service, because there is no public transit or senior options that will provide this trip. The Med Ride II has very limited capacity and usually fills up weeks in advance.
- A person with disabilities who wants to travel from Franklin to Bozrah is not within the New London County DAR service area. If he or she cannot afford the ECTC voucher program, they may be out of options.
- A mother needs to get her children to childcare and herself to work by 7 am. She travels via SEAT fixed route service through three different municipalities and has to walk multiple miles from the bus stops to get to where she needs to go, which takes two hours in the morning and two hours at night. There are no other transportation options for her.

From these examples, it is clear that the region would benefit from additional transportation options and increased transportation funding.

4 SOLUTIONS AND STRATEGIES

A goal of the SEAT Comprehensive Operations Analysis is to improve the coordination of community transportation services in the SCCOG region by identifying other innovative strategies to enhance transportation services to older adults, persons with disabilities, and persons with low income.

As described above, the study area is generally well-covered by existing transportation services; however there are several mobility management strategies that could be used to expand services to individuals whose unmet needs are identified above. Using a nationwide inventory of best practices and successful solutions, the Study Team developed four broad strategies that offer low-cost solutions:

- One-Call/One-Click Central Directory
- Flexible Travel Voucher
- Coordinated Volunteer Driver Program
- Vehicle Sharing Program

The goal of each of these strategies is to fill service gaps and otherwise provide more efficient utilization of transportation services and resources pertinent to the target populations.

STRATEGY #1: ONE-CALL/ONE-CLICK CENTRAL DIRECTORY

Within the study area, there are dozens of different service providers each transporting different population groups for different purposes. To make sense of this tangled web of existing services, there needs to be an online and over-the-phone option for obtaining transportation information. ECTC provides a resource directory in-print and online, called Getting around Eastern Connecticut. The directory provides eligibility and service information for each type of public transportation available in the region. The directory is also broken down by municipality to allow individuals to search for transportation options available in their town of residence. The Getting around Eastern Connecticut directory was last updated in 2013 and is posted in PDF form on the ECTC website. ECTC is currently working on an updated version. In addition to the in-print and online directory, an ECTC mobility specialist is available via telephone and social media to work one-on-one with individuals and agency representatives to identify transportation options.

ECTC's regional directory is a step above many of resources available in rural areas, but is also far less customer-friendly and interactive than some of the national best practices embraced by both urban and rural regions.

How it works

People in search of transportation services often do not know where to begin or what services are available to them. A central information and referral service provides customers with a single point of contact (i.e. a "one-click") where individuals can learn about available community transportation resources in order to schedule rides they need for daily activity or for occasional appointments. Additionally, a "one-call" feature helps reach individuals who have difficulties reading or understanding how to navigate printed materials.

A central directory provides customers with information about all available transportation resources including volunteer driver programs, voucher programs, bus schedules, human service and senior transportation, and ticket information. ECTC essentially provides both the "one-click" and "one-call" features; however, it is recommended that ECTC improve the "one-click" element of the directory to be more interactive.

Ideally, a resource directory is provided on a separate website with a regionally-appropriate name and provides information in a searchable format. The website asks the user triage questions in order to populate the exact transportation options that will work based on the individual's eligibility requirements, such as age, disability, residency, or program participation. Additionally, information can be updated easily by the website administrator and provides a function for transportation providers to easily submit changes to their system information. This ensures that the resource is always up to date and accurate.

➲ Application to the Study Area

Many regions utilize existing 2-1-1 information programs to serve as a one-call/one-click directory. This is a very low cost solution that offers a (usually) willing lead agency (in this case 2-1-1 Connecticut) to supplement an existing information directory with transportation options. Since ECTC has already been working to update their Getting Around Eastern Connecticut guide, ECTC could provide the finished guide to 2-1-1 Connecticut to load into their web-based system. Once this information is loaded into 2-1-1 Connecticut, users will be able to go online or dial 2-1-1 to speak to an operator. SEAT, SCCOG, and ECTC will need to notify the community that this resource is available and notify transportation providers that information will need to be updated through 2-1-1 as service changes occur.

Although utilizing 2-1-1 Connecticut is an easy, cost effective way to provide the central directory in a more interactive and searchable way, ideally the region would develop a separate website to provide transportation information. ECTC is currently looking into how they can make the resource directory more interactive.

STRATEGY #2: FLEXIBLE TRAVEL VOUCHERS

The existing ECTC voucher program offers vouchers for rides in private operators (taxi and livery providers) to people with disabilities. Expansion of this program to a ***flexible travel voucher program*** would allow the use of ECTC vouchers with volunteer drivers and friends/family members, so an individual would be able to stretch their dollar further. Moreover, with additional funding, the program eligibility could be expanded to include seniors in order to fill additional service gaps in the study area.

How it works

Flexible Travel vouchers are provided by a sponsoring organization to an eligible individual (eligibility determined by the sponsoring organization) for travel using a variety of transportation resources that are willing to participate in the program. Transportation operators might include public transit or paratransit, taxis or private for-hire service providers; volunteer drivers, or a friend or family member. The goal is to give the power of choice to the individual who can choose which service on which they will spend their voucher money.

Vouchers provide a flexible travel option that can both provide cost saving benefits to transportation providers and expand and enhance transportation options for individuals, especially in rural areas where transportation resources are scarce. Travel vouchers can be issued or sold to eligible individuals and used by those individuals to either (a) subsidize the cost of a ride on any mode of public transportation that has a fare or requested donation (e.g., transit, paratransit, taxi, senior van); or (b) pay volunteer drivers,

friends, family members, or neighbors for rides. Typically, sponsoring organizations subsidize all or a part of the fare or cost of the trip, so that riders are able to receive service at a reduced cost. As determined by the sponsoring organization, eligibility can be based on age, disability, income criteria, or the need for a specific type of trip, such as employment transportation.

➲ Application to the study area

As described above, ECTC already provides a voucher program for people with disabilities, so they have the infrastructure in place to administer an expanded flexible voucher program. Additionally, through the ECTC Caregiver Mileage Reimbursement program, ECTC already allows individuals who live within the New London County DAR service area to recruit their own volunteer drivers to use.

Including volunteer drivers and friends/family members into the disability voucher program would be a low-cost task that could provide substantial cost savings to individuals who currently are limited to only using expensive taxi and private operators. In terms of liability, ECTC could retain their policy that participants find their own volunteer drivers (through the ECTC Caregiver Mileage Reimbursement Program), so ECTC is not liable for the volunteer's actions or any accidents that might occur. Alternately, as described in the Volunteer Driver strategy below, ECTC could join with other volunteer driver programs to obtain discount liability insurance so they can be active in recruiting volunteers.

Additionally, with a small amount of additional funding (possibly Section 5310 or Title III funding), the program eligibility could be expanded to include seniors, which would provide vital transportation to seniors who need to access services on the weekends when transportation is not available.

Along with volunteers and friends/family members, ECTC should consider adding Transportation Network Companies (TNCs), such as Uber and Lyft to the flexible voucher program. These companies provide an option that is more affordable than a taxi and more flexible and reliable than a volunteer driver. Uber and Lyft are both operating in the study area. Although working with these companies through a voucher program is complicated, it is not impossible. Both Uber and Lyft allow purchase of gift cards. If a tech-savvy voucher user wanted to use Uber/Lyft for their transportation needs through the voucher program, ECTC could purchase an Uber or Lyft gift card in the amount of the voucher booklet (with the user paying the same amount as with current vouchers). The user could then load the gift card balance onto their Uber/Lyft account and draw down on the balance as they take rides. Although this system is more complicated to implement, TNCs are quickly becoming a dominant demand responsive option for many regions, and are a customer favorite.

STRATEGY #3: COORDINATED VOLUNTEER DRIVER PROGRAM

This strategy could be implemented in conjunction with flexible travel vouchers. Volunteer driver programs have proven to be an effective and important resource to help supplement public transportation options in the study area. There are already several volunteer driver programs providing services in the area that could work more efficiently if they were to coordinate and work together to expand into new areas.

How it works

Volunteer drivers are individuals who volunteer to drive people who lack other mobility options. A sponsoring organization, such as a transportation provider, human service agency, or other entity often helps match volunteer drivers with individuals who need rides. Volunteer drivers will typically use their private vehicle but will be reimbursed, usually based on mileage driven, by the sponsoring agency. Other volunteer driver programs – but not in the study area – provide the vehicle. Volunteer drivers are

typically used for trips that are more difficult to serve and to fill in the transportation gaps where and when public transportation is not available.

There are a range of options for coordinating volunteer driver programs. For example, full consolidation of volunteer driver programs in the area involves sharing volunteer driver pools and centralizing the administration/management of the various programs to one agency or organization. On the other end of the spectrum, existing volunteer driver programs could alternatively coordinate one or more administrative duties or simply share information. It is common for volunteer driver programs to join together to obtain insurance discounts and share information on successful recruitment and retention practices.

➲ Application to the study area

The concept behind this recommendation is that it may be easier to expand a larger consolidated/coordinated volunteer program to areas not currently served by approaching a local municipality or organization – a senior center, for example – in those areas willing to financially participate in such a venture if the administration and management of the program is covered. Certain municipalities - Colchester, East Lyme, Franklin, Lisbon, and Sprague - generally have less service than more urban parts of the region. It is suggested that senior centers available in some of these municipalities could serve as the lynch-pin to such a "pitch" to these municipalities because (1) they may have seniors who have difficulty getting to the center, and (2) they can serve as the local driver recruiter.

A second benefit of a larger consolidated/coordinated program is the potential to attract more drivers during off-peak hours and during the weekend. A third benefit – especially true for consolidated programs – is that the resulting more streamlined program administration/management may allow for more funding to be used for volunteer driver reimbursement and less for administration.

Lastly, because of its simplicity, broader application, and more visible credibility, a "companion" flexible voucher program could potentially induce more drivers to volunteer in the areas currently served and new drivers to volunteer in the expansion areas.

There are three volunteer driver programs currently operating in the study area:

- The American Cancer Society Road to Recovery volunteers provide rides to cancer patients who need transportation to cancer-related medical appointments throughout the study area (and nationwide).
- Seniors Helping Seniors volunteer drivers serve older adults and people with disabilities with their general transportation needs in Griswold, North Stonington, Preston, Ledyard, Stonington, Norwich, and Groton.
- ECTC Caregiver Mileage Reimbursement program provides mileage reimbursement to people who are eligible for the New London County DAR program in Bozrah, Lisbon, Griswold, East Lyme, Groton, New London, Waterford, Ledyard, Stonington, and North Stonington. Participants are required to recruit their own drivers because ECTC does not have the proper insurance to cover a more formal volunteer program.

ECTC and Seniors Helping Seniors are operating in adjacent parts of the study area. They could coordinate their volunteer driver programs by sharing resources and information in order to better serve the community. A coordinated volunteer driver program would offer the following advantages and cost savings:

- Shared forms and procedures
- Shared grant applications

- Shared driver training
- Shared recruiting and retainment techniques

Additionally, ECTC does not actively recruit and retain volunteer drivers for their program because of insurance restrictions. If they worked together with Seniors Helping Seniors both programs could potentially obtain discounted insurance to cover volunteer drivers. If the ECTC program was to start a formal driver recruitment program, they would be able to serve a wider number of individuals and potentially reduce costs if some participants were able to use volunteer drivers instead of the more costly New London County DAR service.

ECTC is the logical lead agency for this strategy as they have an informal volunteer driver program already in place that could be expanded if additional funding was obtained to pay for the increased liability insurance and additional staff time needed to administer the program.

STRATEGY #4: VEHICLE SHARING

This strategy provides a solution to the problem of limited weekend and evening service throughout the study area; it works by utilizing existing vehicles that are unused during these periods.

How it works

Vehicle sharing can be accomplished in several ways. An organization might own and maintain a fleet of vehicles that are used by one or more organizations, with each organization paying for their share of the vehicle based on capital investment and miles used. Two organizations could agree to share a single vehicle; agencies might agree to share access to back-up vehicles; or agencies may have agreements that allow clients from different programs to ride on a single vehicle. Shared vehicles can be rented on an ongoing or one-time basis and may fill a number of different needs, including temporary increased demand or temporary decreased supply (due to out of service vehicle).

This strategy typically brings together providers with complementary vehicle requirements to share vehicles – for example, an organization that needs to use vehicles in the peak periods can be paired with one needing vehicles during mid-day periods or on weekends only. This can reduce unnecessary vehicle capital and operating expenses and ideally will result in a total fleet that is the right size for the region. Vehicle sharing can also make accessible vehicles available to a wider range of passengers as it enhances existing community transportation resources.

➲ Application to the study area

Throughout the study area there is a lack of weekend and evening transportation to non-medical services, especially outside of the SEAT service area. Even within the SEAT service area, SEAT transit is only available until 7:00 pm on the weekday and has reduced hours and routes on the weekend.

None of the senior or human service transportation options are available on the weekend or in the evening (except for the voucher and volunteer driver programs), which means that there are more than a dozen vehicles throughout the study area sitting unused during these times. If the region were to create a shared vehicle program, these vehicles could be used to provide on-demand weekend and evening service.

For this program to work there would need to be a lead agency, such as SEAT or ECTC that could work with area organizations to administer and manage the vehicle sharing program. Organizations that offered their vehicles for use on the weekend and in the evening would be compensated by other organizations using the vehicles during these times. The lead agency would be responsible for coordinating a shared system and determining a fair rate, which would require additional staff time. Funding could be obtained by through a grant (such as Section 5310) and/or by bringing in local

organizations that would benefit from weekend service, such as area churches. Local employers could be called on to provide funding for evening or late night service, such as the areas casinos and tourist service companies. Alternatively, the service could be provided as a "premium" service for area seniors and people with disabilities willing to pay extra for the ability to travel during these times.

There are a number of challenges that would need to be considered by the region, if this strategy were to be implemented:

- Some funding programs restrict the use of funds (and thereby vehicles) to certain activities; however, in most cases there is a minimum number of service that must be provided on a certain vehicle in order to gain funding, but additional service over that minimum is allowed.
- If ECTC was chosen as the lead agency, the service model would need to be changed slightly to serve both private and non-profit clients.
- There is also the issue of finding additional funding to support the administration of a vehicle sharing program. Although Southeastern Connecticut has limited access to federal transportation funding, this type of program could be funded through private grants, foundations, partnership with local hospitals or through federal funding for human service programs or older adults.
- The State of Connecticut has financial limitations and it is not clear grant funds would be available to help design a coordinated system. CTDOT recently issued an RFP for Section 5310 projects, but responses were limited to vehicle purchases.

Although there are challenges to overcome, vehicle sharing has proven successful in several nationwide case studies.

Case Studies

The GoRide Vehicle Sharing Program, Valley Ride, Meridian, Idaho is a pool of vehicles for human service agencies and non-profit organizations in Ada and Canyon Counties to use when needed. The pool of GoRide vehicles includes a variety of vehicle sizes and does include vehicles with wheelchair lifts. This allows agencies and organizations to access vehicles that are appropriate for the trip they are making. Agencies and organizations can join the GoRide Vehicles Sharing program and must have a least one driver certified. Vehicles are allocated on a first come first serve basis. All drivers operating a GoRide vehicle must be approved prior to the agency or organization requesting a vehicle. There are three types of memberships: Annual Donating, Annual Participating and Participating. A Donating Member is an agency or organization that currently has a vehicle but does not need it seven days a week, or only uses the vehicle during the day or evening. The Annual Donating Member donates their vehicle to the GoRide Vehicle Sharing Program. In exchange, VRT insures and maintains the vehicle. GoRide staff use Kelly Blue Book trade-in value for cars and vans and resale value for buses to determine the value of the donated vehicle. At this point, VRT becomes owner of the vehicle and the van or bus goes into service as a shared vehicle. The value of the vehicle is credited toward the cost of the Donating Members annual membership cost. With VRT paying for everything but the fuel and a driver, the participating organization is out nothing but the dollars wasted for when the vehicle owned outright was sitting idle.

BerkshireRides, Berkshire County, Massachusetts. United Way worked with BerkshireRides to set up a vehicle sharing pool to meet common needs of transporting school kids to after school programs. The seven primary partners provide trips to/from after-school activities and youth development activities. Agency members pay an annual fee of $1,500 for the priority scheduling on one vehicle. Secondary users can rent the vehicles for $100 per day when they are available. All agencies must hire or pay their own drivers and pay for fuel.

Jefferson Union High School in Daly City, California (JUHSD) joined with the Pacific Forest and Watershed Lands Stewardship Council and the City of Daly City to purchase five new vans for the purpose of supporting outdoor activities for teenagers. During school days, JUHSD has first priority for the use of

the vans, but Daly City has priority access to the vans during breaks and after school. The two entities also share maintenance and insurance expenses for the vans. In addition, JUHSD rents its other vehicles to the municipalities of Daly City, Brisbane, Pacifica and Colma (the communities served by the school district) for after-school activities and general use. JUHSD's vehicle-sharing program benefits both JUHSD and local municipalities—the district receives rental income while the municipalities receive affordable access to vehicles for special events/programs. JUHSD has 10 school buses and eight 10-passenger vans as well as the five cans in the shared fleet with Daly City.

King County Metro, King County, Washington, through its Community Access Transportation (CAT) Program, provides non-profit agencies with accessible vans, maintenance, and driver training. In return, the agencies agree that they will serve ADA-registered customers in addition to their own clients. Metro provides lift-equipped vans with maintenance and driver training. The primary vehicle users provide drivers, scheduling functions, comprehensive and liability insurance, and transportation service for customers, including at least 50 one-way trips per month for ADA eligible customers. In 2008, the average cost for a CAT trip was $4.80, compared to an ACCESS trip of $39.17. The annual cost savings to Metro for the program is over one million dollars.

APPENDIX G

Memorandum on Local SEAT Funding Contributions

LOCAL FUNDING CONTRIBUTIONS FOR SEAT

The Nelson\Nygaard team has developed two Cost Neutral SEAT Improvement Plans. These plans each represent a set of service improvements that would be budget neutral when implemented on a systemwide basis. A revised local funding formula was applied to both plans to determine the local match share for each member town. The two plans are summarized below and presented on the following pages.

- **Cost Neutral Plan A:** Run 10 in Stonington and Run 3 in East Lyme are discontinued, with resources redirected to increase service in more productive areas. Frequency on Route 600 New London-Norwich is increased from every 120 minutes to every 60 minutes, and a limited-stop Route 980X is added between New London and Three Rivers Community College. Service spans are also improved on a few other routes.
- **Cost Neutral Plan B:** Route 626 Pawcatuck and Route 624 East Lyme are added. Route 600 frequency is reduced back to 120 minutes. Route 980X and service span improvements under Cost Neutral Plan A are maintained.

The Recommended SEAT Improvement Plans also include a series of priority actions for future system expansion, if and when additional resources are identified. These expansion options may be implemented individually or concurrently, and implementation would rely on the availability of new sources of funding. Therefore, only the two cost neutral plans are included here.

Local SEAT Funding

The revised formula is based on the amount of service received by each member town, accounting equally for hours of service and miles of service that each town receives. The table below summarizes the total local match under each SEAT Improvement Plan, as well as the estimated share of local match funding to be provided by each town.

	Existing System Local Match (Current Formula)		SEAT Improvement Plan Local Match (Revised Formula)			
Town			Cost Neutral Plan A		Cost Neutral Plan B	
East Lyme	$6,311	1%	$0	0%	$5,835	1%
Griswold	$7,255	1%	$11,386	2%	$11,354	2%
Groton	$93,592	19%	$81,631	16%	$82,450	16%
Ledyard	$9,717	2%	$21,615	4%	$21,538	4%
Lisbon	$7,255	1%	$33,681	7%	$33,585	7%
Montville	$16,879	3%	$27,476	5%	$18,787	4%
New London	$148,312	29%	$104,489	21%	$99,296	20%
Norwich	$163,655	32%	$161,918	32%	$157,142	31%
Stonington	$5,256	1%	$15,849	3%	$30,004	6%
Waterford	$47,052	9%	$47,238	9%	$45,292	9%
SEAT Total	$505,283	100%	$505,283	100%	$505,283	100%
Peak Vehicles	*18*		*17*		*18*	

COMPARISON OF SERVICE RECEIVED AND LOCAL MATCH BY TOWN, CURRENT SERVICE

Town	Population		Hours of Service, Annual		Miles of Service, Annual		Estimated Cost of Service Received, Annual		Local Match Formula	FY16 Total Local Match	
East Lyme	19,119	9%	900	1%	16,731	2%	$99,511	2%		**$6,311**	1%
Griswold	11,959	6%	3,424	5%	46,870	5%	$324,161	5%		**$7,255**	1%
Groton	40,096	19%	7,316	12%	136,744	14%	$811,497	13%	*(formula historically used was hours of service*	**$93,592**	19%
Ledyard	15,051	7%	2,846	5%	66,825	7%	$359,964	6%	*in each town, but percentages were not kept*	**$9,717**	2%
Lisbon	4,334	2%	3,627	6%	58,946	6%	$373,609	6%	*current over time)*	**$7,255**	1%
Montville	19,621	9%	2,402	4%	37,434	4%	$242,227	4%		**$16,879**	3%
New London	27,578	13%	12,490	20%	171,325	18%	$1,183,670	19%		**$148,312**	29%
Norwich	40,413	19%	20,453	33%	276,590	29%	$1,941,598	31%		**$163,655**	32%
Stonington	18,527	9%	3,906	6%	78,241	8%	$450,263	7%		**$5,256**	1%
Waterford	19,508	9%	4,983	8%	69,597	7%	$476,288	8%		**$47,052**	9%
SEAT Total	216,206	100%	62,347	100%	964,264	100%	$6,262,788	100%		**$505,283**	100%

Current Peak Vehicles: 18

COST NEUTRAL PLAN A

Town	Population		Hours of Service, Annual		Miles of Service, Annual		Estimated Cost of Service Received, Annual		Local Match Formula: 50% Local Match from Hours of Service	+	50% Local Match from Miles of Service	=	Total Local Match	
East Lyme	19,119	9%	0	0%	0	0%	$0	0%	$0		$0		**$0**	0%
Griswold	11,959	5%	1,585	2%	17,883	2%	$141,124	2%	$6,203		$5,183		**$11,386**	2%
Groton	40,096	18%	9,831	15%	148,875	17%	$1,011,785	16%	$38,482		$43,149		**$81,631**	16%
Ledyard	15,051	7%	2,136	3%	45,734	5%	$267,916	4%	$8,360		$13,255		**$21,615**	4%
Lisbon	4,334	2%	4,687	7%	52,900	6%	$417,462	7%	$18,349		$15,332		**$33,681**	7%
Montville	19,621	9%	3,426	5%	48,522	6%	$340,551	5%	$13,412		$14,063		**$27,476**	5%
New London	27,578	12%	13,602	21%	176,812	20%	$1,295,102	21%	$53,243		$51,246		**$104,489**	21%
Norwich	40,413	18%	21,964	34%	262,018	30%	$2,006,909	32%	$85,976		$75,942		**$161,918**	32%
Stonington	18,527	8%	1,383	2%	36,008	4%	$196,442	3%	$5,413		$10,436		**$15,849**	3%
Waterford	19,508	9%	5,928	9%	82,925	10%	$585,498	9%	$23,204		$24,035		**$47,238**	9%
SEAT Total	216,206	100%	64,541	100%	871,676	100%	$6,262,788	100%	$252,642		$252,642		**$505,283**	100%

Percent Share of Each Route's Mileage by Town												
600	**601**	**610**	**611**	**612**	**613**	**620**	**621**	**622**	**623**	**980†**	**981†**
-	-	-	-	-	-	-	-	-	-	-	-
-	-	-	-	-	17	-	-	-	-	-	-
-	33	-	-	-	-	42	51	-	-	-	25
-	33	-	-	-	-	-	-	-	-	-	25
-	-	-	-	-	50	-	-	-	-	-	-
40	-	-	-	-	-	-	-	-	-	25	-
17	-	-	-	-	-	28	49	93	24	25	25
20	33	100	100	100	33	-	-	-	-	25	-
-	-	-	-	-	-	-	-	-	-	-	25
23	-	-	-	-	-	30	-	7	76	25	-
100	100	100	100	100	100	100	100	100	100	100	100

Peak Vehicles: 17

†Route 980 and Route 981 apportioned equally among towns with stops.

COST NEUTRAL PLAN B

Town	Population		Hours of Service, Annual		Miles of Service, Annual		Estimated Cost of Service Received, Annual		Local Match Formula: 50% Local Match from Hours of Service	+	50% Local Match from Miles of Service	=	Total Local Match	
East Lyme	19,119	9%	693	1%	10,837	1%	$72,318	1%	$2,711		$3,124		**$5,835**	1%
Griswold	11,959	5%	1,585	2%	17,883	2%	$140,724	2%	$6,198		$5,155		**$11,354**	2%
Groton	40,096	18%	9,831	15%	152,614	17%	$1,021,931	16%	$38,455		$43,995		**$82,450**	16%
Ledyard	15,051	7%	2,136	3%	45,734	5%	$266,959	4%	$8,354		$13,184		**$21,538**	4%
Lisbon	4,334	2%	4,687	7%	52,900	6%	$416,279	7%	$18,336		$15,250		**$33,585**	7%
Montville	19,621	9%	2,331	4%	33,548	4%	$232,863	4%	$9,116		$9,671		**$18,787**	4%
New London	27,578	12%	12,820	20%	170,493	19%	$1,230,733	20%	$50,147		$49,149		**$99,296**	20%
Norwich	40,413	18%	21,415	33%	254,522	29%	$1,947,710	31%	$83,769		$73,373		**$157,142**	31%
Stonington	18,527	8%	3,516	5%	56,368	6%	$371,888	6%	$13,754		$16,250		**$30,004**	6%
Waterford	19,508	9%	5,573	9%	81,488	9%	$561,381	9%	$21,801		$23,491		**$45,292**	9%
SEAT Total	216,206	100%	64,587	100%	876,385	100%	$6,262,788	100%	$252,642		$252,642		**$505,283**	100%

Percent Share of Each Route's Mileage by Town													
600	**601**	**610**	**611**	**612**	**613**	**620**	**621**	**622**	**623**	**624**	**626**	**980†**	**981†**
-	-	-	-	-	-	-	-	-	-	69	-	-	-
-	-	-	-	-	17	-	-	-	-	-	-	-	-
-	33	-	-	-	-	42	51	-	-	-	-	-	25
-	33	-	-	-	-	-	-	-	-	-	-	-	25
-	-	-	-	-	50	-	-	-	-	-	-	-	-
40	-	-	-	-	-	-	-	-	-	-	-	25	-
17	-	-	-	-	-	28	49	93	24	-	-	25	25
20	33	100	100	100	33	-	-	-	-	-	-	25	-
-	-	-	-	-	-	-	-	-	-	-	100	-	25
23	-	-	-	-	-	30	-	7	76	31	-	25	-
100	100	100	100	100	100	100	100	100	100	100	100	100	100

Peak Vehicles: 18

† Route 980 and Route 981 apportioned equally among towns with stops.